MACHINERY

Volume 44 NEW YORK, MARCH, 1938 Number 7

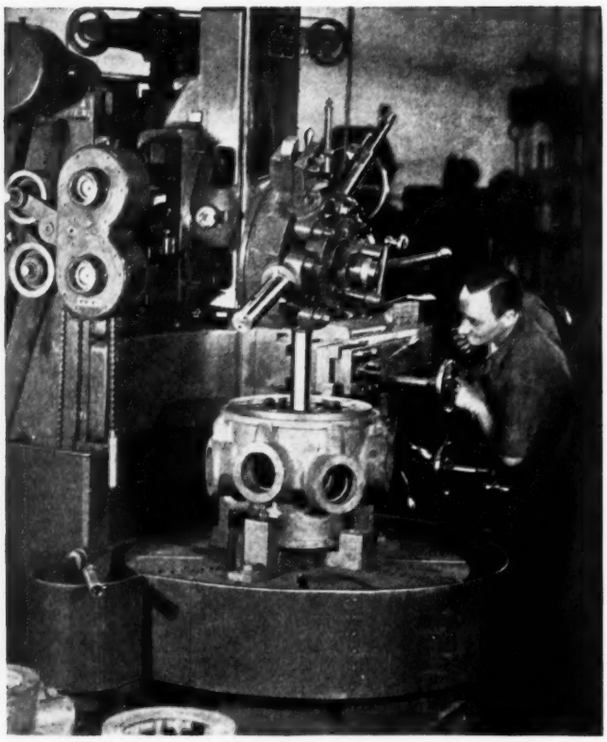
Manufacturing Methods in the Air-Conditioning Industry

Some of the Important Machining Operations that Insure Efficient Performance of Airtemp Radial Air-Conditioning Compressors

By CHARLES O. HERB

TEN years ago one would have been called a dreamer if he had predicted that within a few years every room in a 650-room hotel would be air-conditioned. Or that people could travel on trains in cool comfort from coast to coast during the summer months when the temperature outside exceeded 100 degrees F. Or that factories would find it practical and profitable to air-condition entire departments, as the Ford Motor Co. and the International Business Machines Corporation have done.

Nevertheless, all these things have been realized within the space of a few years, so that today, people can work, sleep, travel, and amuse themselves in comfort, regardless of heat and humidity. A new industry has grown up—one in which 125



this part, which is a fine-grained iron casting, are performed on Bullard vertical turret lathes. Fig. 1 illustrates the first operation on a seven-cylinder crankcase, which has an outside diameter of approximately 22 inches and an over-all length of about 16 inches. In this operation, tools on the turret bore hole *A*, Fig. 2, and face boss *B*. At the same time, tools on the cross-slide turn surface *C* and face surfaces *D* and *E*. The dimension between face *D* and the center of the No. 4 cylinder bore must be held to 5.500 inches within plus or minus 0.002 inch, and a similar tolerance is specified for the distance between faces *B* and *D*.

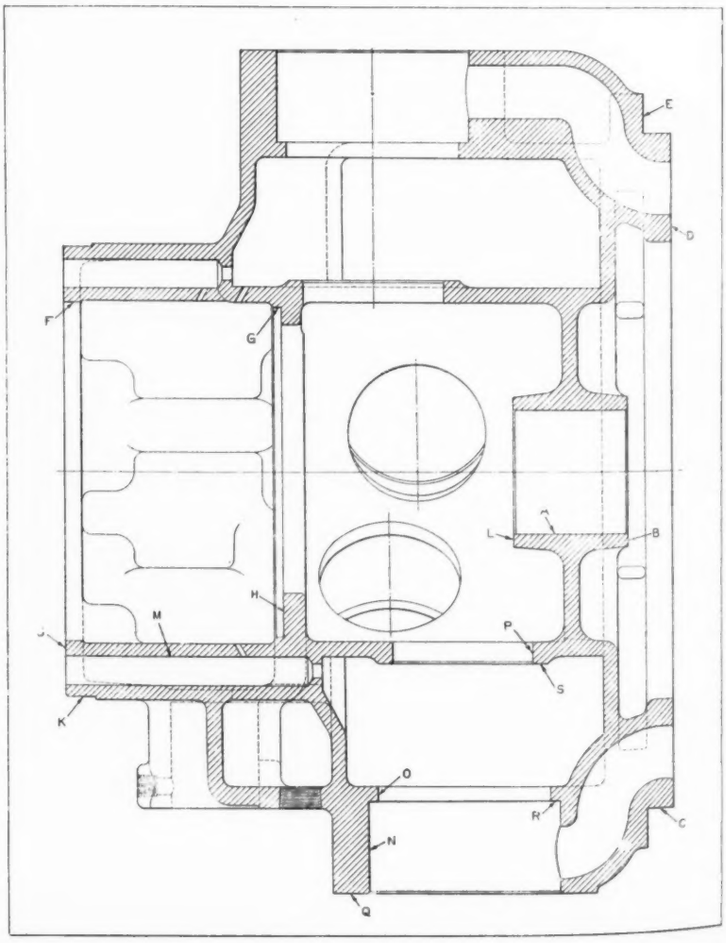
In the second operation, which is performed on the same machine, the crankcase is accurately located by seating the bored hole *A* on a plug mounted on the table. Hole *F* and recess *G* are bored in this operation with tools on the turret, and the tool that bores recess *G* also faces the flange surface *H*. At the same time, surface *J* is faced with a tool on the cross-slide, a tolerance of only 0.003 inch being specified on the distance between surfaces *D* and *J*, which is nominally 15.750 inches. Surface *K* is next turned with a tool on the turret, after which bearing hub *L* is faced with a fly cutter attached to a bar that is also mounted on the turret. The distance

Fig. 1. (Above) First and Second Operations on Radial-cylinder Compressor Housing or Crankcase are Performed on Vertical Turret Lathes. Fig. 2. (Below) Cross-sectional View through Airtemp Seven-cylinder Compressor Crankcase

manufacturers reported having received orders during 1937 amounting to approximately $75,000,000.

One of the outstanding manufacturing plants of this new industry, because of the facilities that have been provided for quantity production of air-conditioning equipment, is that of Airtemp, Inc. (a Chrysler subsidiary), which is located in Dayton, Ohio. The refrigeration equipment manufactured by this concern for air-conditioning is designed around a radial type of compressor, the larger sizes of which somewhat resemble an air-cooled airplane engine. These compressors are made in two styles, one having either two or three cylinders with capacities of 1, 1 1/2 and 3 horsepower, and the other, three, five, or seven cylinders with capacities of 10, 15, 25, and 37 1/2 horsepower. In addition, there is a double-end compressor consisting of two seven-cylinder units, operated by a single motor having a double extension shaft. This equipment has a rating of 75 horsepower. The outstanding machining operations on these compressors will be described in the following.

Accurate machining of the radial-cylinder casting, or crankcase, as it is called in the shop, is of prime importance. The preliminary operations on



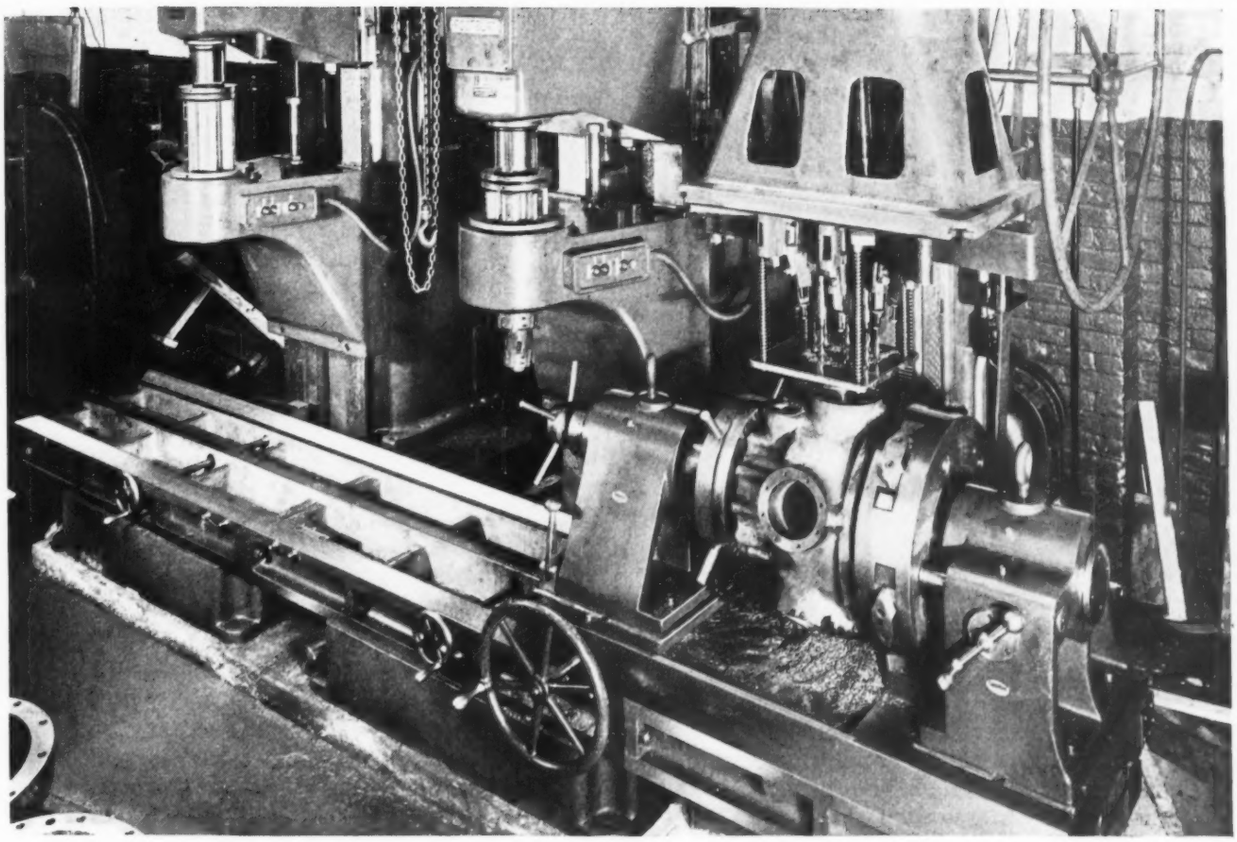


Fig. 3. Battery of Three Machines Used for Boring Operations on the Cylinder Holes and for Drilling the Cylinder-head Bolt Holes around the Cylinder Bosses

between faces *B* and *L* must be held within a tolerance of 0.002 inch.

Two multiple-spindle drilling machines are next employed for drilling and reaming approximately 150 holes in the crankcase and cover. For these operations, the crankcase is mounted in a trunnion jig which runs on a track extending beneath the two machines. This jig can be turned on its trunnions to index the crankcase with respect to the crankshaft axis. Some of the holes drilled in this operation are of considerable depth, hole *M*, for example, being drilled and reamed to a depth of 6 1/4 inches. It is 47/64 inch in diameter.

Boring Operations on the Radial Cylinders

The crankcase is next loaded into another trunnion jig, which slides on the track beneath the machines illustrated in Fig. 3. Plugs on the faceplates of this jig engage holes *A* and *F*, Fig. 2, and the crankcase is firmly clamped between the faceplates and on dowel-pins by tightening the spider wheel on the left-hand tailstock. The faceplates are mounted on the trunnions, so that the crankcase can be indexed on its crankshaft axis to bring each cylinder bore upward into position for machining.

As the cylinder bores are offset or staggered with relation to a center line passing through any one of them, the crankcase must also be shifted lengthwise each time that it is indexed, so as to bring the center of each cylinder bore into line with the tool. The minimum offset between the center of any two cylinder bores is 0.373 inch, and the maximum offset 2.252 inches.

To provide for the endwise shifting of the crankcase, the jig is so designed that the trunnions, faceplates, and work are adjusted together as the work is indexed, and the diamond-shaped blocks seen on the periphery of the right-hand faceplate in Fig. 3 engage a slot in a block located on the jig base. The diamond-shaped blocks are offset from each other around the faceplate in the same relation as the cylinder bores, and therefore, as the crankcase is indexed, the diamond-shaped blocks shift the work lengthwise the required amount to suit the individual bores as they are brought to the top of the jig.

The right-hand faceplate and the work are locked in the different indexed positions by sliding a round bar at the front of the jig into locating holes in the right-hand faceplate. The jig is traversed along the track by turning a large handwheel which actuates a pinion attached to the jig that engages a rack on the bed. Accurate locating of the jig beneath each machine is effected by a locking pin attached to the jig, which enters bushings in the

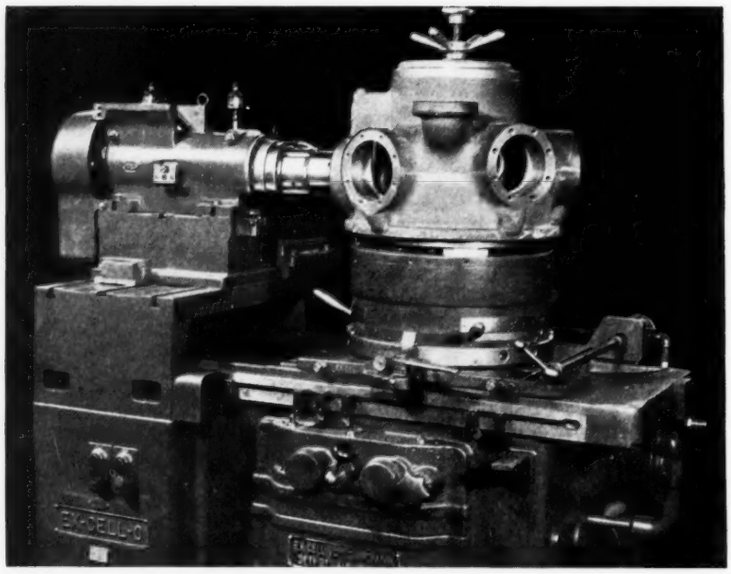


Fig. 4. Precision Boring Machine with Hydraulically Operated Fixture, the Height of which is Easily Adjustable to Suit the Staggered Cylinder Bores

bed. The locking pin is lowered and raised by the small lever on the left-hand end of the jig.

This jig can be used for crankcases with three, five, or seven cylinders by merely changing the right-hand faceplate which, as already explained, also serves as an index-plate. The indexing in these operations is done very accurately, because the angle of the different cylinder bores with relation to the crankshaft axis is given in seconds.

The Foote-Burt machine at the left end of the group in Fig. 3 is fitted with a combination boring and facing tool similar to that seen attached to the spindle of the middle machine. The combination tool of the first machine rough-bores holes *N*, *O*, and *P*, Fig. 2, of each cylinder, faces surfaces *Q*, *R*, and *S*, and also bevels the corner between hole *P* and surface *S*. Finishing cuts are taken on all these surfaces by the second machine. However, several of the surfaces are precision bored and faced in a subsequent operation.

The Natco multiple-spindle machine at the right-hand end of the group in Fig. 3 drills eight small holes in the boss surrounding each cylinder bore, and these holes are later tapped in a multiple-spindle machine to suit the cylinder-head bolts.

Each cylinder bore *N*, Fig. 2, is precision-bored by the Ex-Cell-O machine illustrated in Fig. 4, which also precision-bores hole *P* and faces surfaces *R* and *S*. There is a tolerance of only 0.002 inch in the distance between surface *R* and the crankshaft center line of the casting. For this operation, the crankcase is seated on a fixture, the height of which can be quickly adjusted with each indexing to bring the successive cylinder bores into line with the spindle of the machine.

Each time that the fixture is to be indexed, the work is withdrawn from the cutter-spindle by traversing the machine table toward the right. Then a plunger operated by a lever at the front center of the fixture is withdrawn from a locating hole

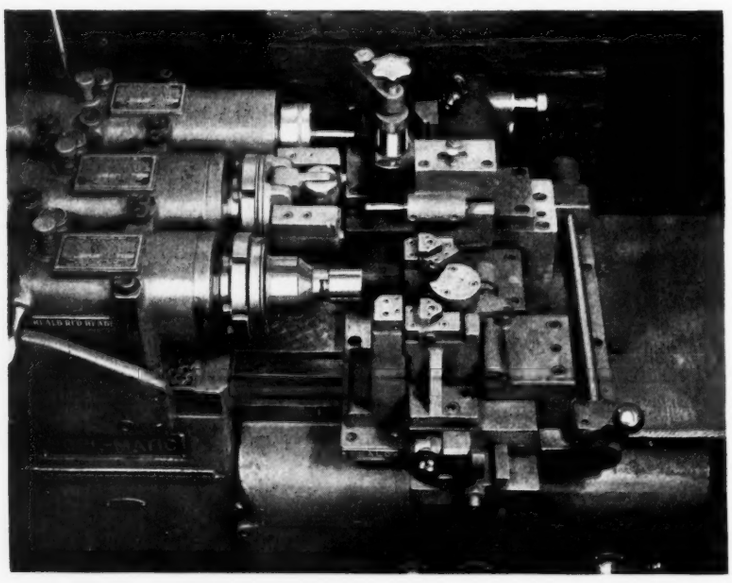


Fig. 5. Borematic with Three Spindle Heads for Simultaneously Taking a Series of Boring, Turning, and Facing Cuts on Small Compressor Pistons

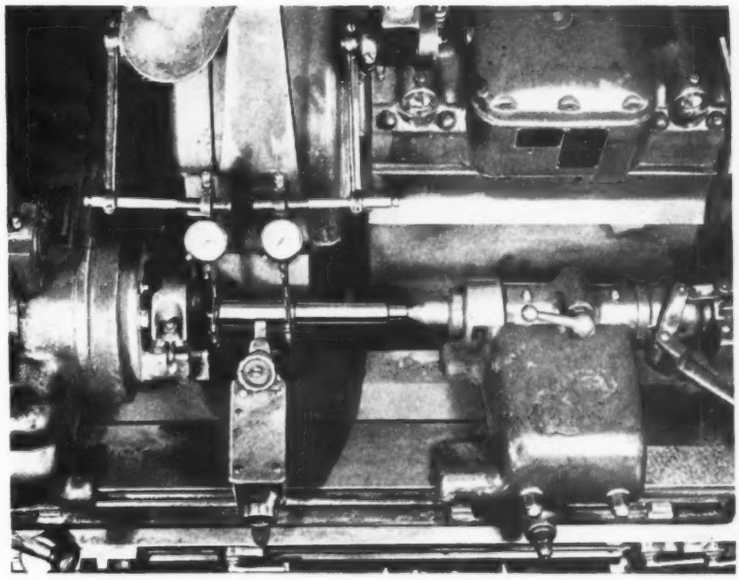


Fig. 6. For Grinding Compressor Crankshafts, the Crankpin End is Supported in a Special Fixture on the Headstock, and the Other End on a Tailstock Center

in the base, so that the fixture can be indexed into position to permit the plunger to enter the next locating hole. Above each of these locating holes there is a small plate, stamped to indicate which cylinder bore is in line with the machine spindle when the plunger is engaged with that hole.

Next, a handle at the right-hand end of the fixture base is operated to open a valve that applies hydraulic pressure for raising the upper portion of the fixture several inches. Then one of the four handles around the fixture is shifted to a number on a plate attached to the wall of the fixture that corresponds to the number of the cylinder that has been indexed into line with the cutter-spindle. The movement of this lever causes three stops to be positioned within the fixture in relation to blocks having steps that vary in height to suit the offset differences of the cylinder bores. These stops regulate the height of the fixture top with respect to the center of the cutter-spindle when the hydraulic pressure is released from the under side of the piston. Pressure is then applied to the top of the piston to hold the fixture firmly on rest blocks for the operation.

Hydraulic pressure is also employed to operate the table to and from the cutter-spindle. Tungsten-carbide cutters are used in this operation, and the diameter of the bores finished by this machine are held to size within plus or minus 0.001 inch.

After a babbitt bearing has been assembled in bore *A*, Fig. 2, and the rear cover, with a babbitt bearing in the center, has been attached to the crankcase, a second Ex-Cell-O precision boring machine is employed to line-bore these bearings. Similar operations on the smaller compressors are performed on a Heald Borematic.

Pistons for the small sizes of compressors are accurately machined by means of the three-head Borematic shown in Fig. 5. For the first step in this operation, the piston is clamped in a vertical

Fig. 7. Two Visual Gages Used for Checking the Parallelism of Valve Header Faces, and the Diameter, Roundness, and Straightness of the Bore in Cylinder Liners

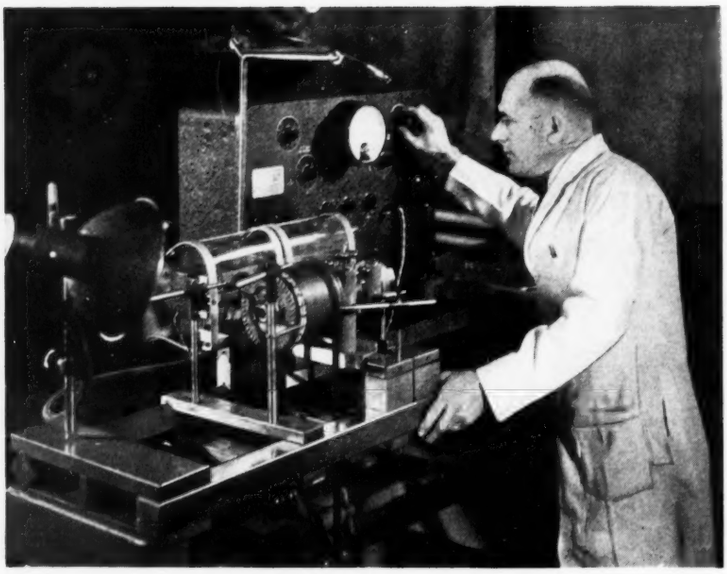


Fig. 8. The Balance of Compressor Crankshafts and Their Assembled Armatures is Accurately Determined by Means of This Electric Type of Balancing Machine

position on its skirt end in a fixture at the rear of the carriage. When the carriage is fed longitudinally by hydraulic power, this piston is carried to a boring-bar on the rear spindle head, which precision-bores the previously drilled piston-pin holes by means of two tungsten-carbide cutters. These holes are bored to from 0.5000 to 0.5002 inch, and they must be square with the piston wall within 0.0015 inch in 4 inches.

The piston is then transferred to the middle boring head, which is equipped with a jig in which the piston is again seated on a plug and clamped on top. Two tungsten-carbide bits in a bar mounted on the carriage are fed longitudinally to depth when the carriage advances toward the head end of the machine. The boring-bar is then moved sidewise through the action of a cross-slide to cut grooves in each of the piston-pin bosses.

Next, the piston is transferred to the front head, on which it is held on an expanding mandrel. In this step of the operation, the outside of the piston is turned, 0.002 inch of stock being left on the diameter for removal by centerless grinding. The turning cut is taken by a tool at the left front of the group at the front of the carriage as the carriage is fed longitudinally. When the carriage has been fed to the end of its movement, another tool at the front is advanced to rough-cut a ring groove. Then a tool at the back finishes this groove and a second tool at the back faces the closed head of the piston to length. Finally a tool on a swiveling post faces the concave piston-head. The carriage and cross-slide movements for actuating the tools are obtained through hydraulic power.

Grinding the Compressor Crankshafts

The crankshaft for these air-conditioning compressors is a simple shaft of several concentric diameters, with a crankpin section at one end. This construction prevents the crankshaft from being held between centers in the machining operations, a fact that presented certain difficulties in planning the grinding operation. Grinding of all surfaces, with the exception of the crankpin, is performed on these parts by holding the crankpin end in a fixture attached to the headstock of the grinding machine. This fixture can be adjusted away from the center of the headstock spindle to correspond with the throw of the crankpin. The opposite end of the crankshaft is supported on a tailstock center. A grinding operation of this kind on a crankshaft for a three-cylinder compressor is illustrated in Fig. 6.

This grinding machine operates on the plunge-cut principle and is equipped with a wheel of 6 inches face width. The wheel is fed hydraulically to and from the work and also longitudinally to position it for grinding the different bearings. The main bearing is ground to from 1.4980 to 1.4985 inches for a length of 4.748 to 4.750 inches. In taking this cut, the crankpin cheek is also ground to length within a tolerance of 0.003 inch.

After the main bearing has been ground, the rotor fit to the left of the main bearing, as seen in the illustration, is also ground within a tolerance of 0.0005 inch. Two dial gages attached to the wheel-head for convenience are swung downward for checking the diameters and the straightness of the bearings.

At the end of this operation, the main and crankpin bearings are honed in a special machine to eliminate all grinding marks and obtain an unusually fine finish. About 0.00015 inch of stock on the diameter is removed in the honing operation.

Typical Inspection Methods

All parts of these air-conditioning compressors are carefully inspected to insure quiet operation and proper balance of running parts in service. Sheffield visual gages of the types illustrated in Fig. 7 are used extensively. They are graduated to 0.0001 inch, and the accuracy of the parts being

inspected is indicated by a shadow falling on the scale when a piece of work is placed on the anvil or mandrel of the gage.

The gage at the left in this illustration checks the parallelism of two faces on a valve header. These faces must be parallel within 0.0001 inch. The gage at the right inspects the diameter, roundness, and straightness of the bore in cylinder liners. Taper is detected by sliding the cylinder liner lengthwise over the contact points on the mandrel which actuate the gage. Out-of-roundness is determined by turning the cylinder liner on the mandrel. The bore diameter of these liners is held to size within plus or minus 0.0001 inch, and the bore must be straight within 0.0001 inch in 5 3/4 inches.

After the motor rotor has been assembled on the crankshaft, this assembly is checked for balance on the Gisholt Dynetric balancing machine illustrated in Fig. 8.

Interchangeability of parts is an important requirement in the manufacture of Airtemp compressors to facilitate assembly. The close accuracy with which the working parts are produced virtually eliminates the necessity of selective fits and insures the long life expected of air-conditioning equipment.

Intangible Advantages Secured by the Installation of New Equipment

By R. L. RICKWOOD, Superintendent
The Blanchard Machine Co., Cambridge, Mass.

FIVE major considerations govern most purchases of new equipment. They are: (1) Need for improvement; (2) nature of improvement; (3) reason for purchase—replacement or need for additional capacity; (4) benefits expected; (5) cost of improvement.

These considerations form the basis of a cold analytical and financial approach to an equipment policy. Each element must be carefully weighed and balanced before a decision is made. Generally, a request for new equipment originates with a manager, superintendent, methods or production engineer, or a foreman. One or more of these men must make some sort of analysis along the lines indicated. Often he has a conviction that this or that equipment is needed. He draws on his own experience for arguments, and generally upon the machine tool builder for information relative to the performance of the new machine.

Unless the problem is considered from all sides, and not from the financial point of view alone, the recommendation will not be complete, and will tend to promote a basic equipment policy that would preclude the purchase of any equipment which does not appear to be a good investment when figures only are studied. Such a policy is dangerous. It ignores the human factor. It overlooks the value of a worker's pride in his work and in the place where he works. It does not permit a manufacturer to take full advantage of new developments.

There should be a constant emphasis on keeping up to date with new equipment and tools. This does not mean that new equipment should not pay its way; it should always do that. There is no sense in changing without gain. Rather, it means that the gain due to using new equipment cannot all be accurately forecast in figures. There are valuable intangible benefits in improved morale incident to good equipment. Keeping equipment up to date is like keeping windows washed and floors clean. Incidentally, it generally helps to keep a shop neat and orderly, if only through the appearance of the new machines themselves. Thus it becomes the duty of the man responsible for initiating requests for new equipment to emphasize intangible considerations, along with his statistical analysis, and to play up these intangible phases as they affect the shop for which he is responsible.

Good Machinery Attracts Capable Workers

Shops with the best equipment can get and hold the best workmen. Supervisors, as well as operators, realize that equipment must pay its own way. There is always a tendency to be satisfied to "nurse" along an old, decrepit machine; but men acquire more self-respect when their tools are dependable. They feel a sense of responsibility when trusted with a new investment, and they themselves keep up to date.

The older men who have had the opportunity to adapt themselves to new equipment become valuable employes. The contrast between such men and those who have had to work with old equipment is striking. The latter acquire habits or get in a rut that prevents them from being fully effective on newer machine tools, through no fault of their own. Their only choice is to stay on, with the handicap of obsolete equipment, or try to get work in a modern shop. Most men cannot afford to take

the chance of finding another job, and are obliged to stay on, knowing that they are falling behind the times. Gradually and imperceptibly there is a loss of buoyancy, spirit, and confidence.

On the other hand, you will find men in the shops with good equipment, who, even though they may be well along in years, are alert, interested, and adaptable. They realize that they are still in the procession and they have a feeling of confidence. Having a background of constant development, and knowing what evolution has taken place in the industry, they are able to take full advantage of the new facilities. In other words, the only good excuse for not putting older men at operating new equipment is that the older man has not been given the opportunity to keep up with the developments over a period of years.

Unless the equipment is modern, the operators, foremen, and management are all likely to fall behind the times. When this happens, costs rise, and some, if not most, of the work goes to other shops. This is a strong reason for keeping equipment up to date.

Effect on the Quality of Work

As equipment gets along in age, quality suffers. There comes a gradual insidious drop in quality which is not apparent. Such change is slow and develops over a long period of years. To illustrate the point, consider a shop equipped, say, twenty years ago with the best gear-cutting machines then available. Suppose that these machines have been well cared for and are still producing gears. Now suppose you have a shop alongside that one that has just been equipped, say last year, with the very best gear-cutting machines now available. Assuming proper intelligence in both shops, which one will produce better gears? If you were buying gears and had to buy the best ones that could be made, there is no question that you would buy those made on the newer machines. Parallel cases may be drawn with all other types of machine tools.

Effect of Good Equipment on Wages

Operators cannot be expected to sense the correct speeds and feeds for modern cutting tools unless they have had experience in using them. They cannot get that experience unless their machine tools are up to date; but when an operator can produce more work by better machines, he can earn more money. Hence, modern machine tools tend to increase wages, and the shops that use them can attract and keep the most skillful operators.

Analysis of losses due to poor equipment policies is not easy, but many workmen, foremen, and superintendents can sense them. Most mechanics feel badly about spoiling a piece of work and are inclined to go slowly on older equipment, so as to avoid spoilage, sometimes incurring costs that are out of reason. When work is spoiled and a scolding follows, the worker feels the injustice in the situation, if he knows that the employer is overlooking economies possible with new equipment. He feels that it is inconsistent to rave about the insignificant cost of replacing the spoiled part, when so many dollars are being thrown away regularly by using poor equipment. This is particularly true when a workman realizes that some fault in his machine has been a contributing cause of the spoilage, although by the use of his own skill, he ordinarily produces good work, in spite of the fault.

These are some of the reasons why a policy of constant replacement of machine tools has been adopted in a number of plants, including that with which the writer is connected—the Blanchard Machine Co. In our particular case, the policy is to replace approximately 10 per cent of the machine tool equipment each year. An effort is made to keep abreast of developments by keeping informed, through trade papers, shop visits, and other means. New machines are studied for the benefits they offer, and selection is based upon these studies. An idea of the results of this policy may be formed by noting the fact that the prices of the machines being built in our plant are only slightly above those of 1923, in spite of increased costs of materials, higher labor rates, and constantly improved standards of quality.

* * *

Great Increase in Machinery Exports

The year 1937 was the second best export year in the history of American manufacturers of industrial machinery, according to the Machinery Division of the Department of Commerce. The total machinery exports for the year were valued at over $240,000,000, an increase of 52 per cent over 1936 when the exports amounted to $158,500,000. The 1937 exports were only 7 per cent below the record figure of $257,000,000 in 1929.

Of these exports, approximately $60,000,000 represented power-driven metal-working machinery, showing an increase of 43 per cent over 1936, when approximately $42,000,000 worth was exported. The largest gains in exports were recorded in turret lathes, thread-cutting and automatic screw machines, milling machines, radial drilling machines, planers, shapers, and internal grinding machines. Exports of rolling mill machinery were also heavy.

* * *

Inventors' Congress and Exposition

A National Inventors' Congress and Exposition is being planned to be held at the Hotel Stevens, Chicago, Ill., April 5 to 8. This is the twenty-fourth meeting and exhibit of this group, of which Roy C. Burns is managing director. It is stated that the 56,000 square feet of exhibit space available will be filled with new inventions and developments, including a very great variety. In this connection, it is mentioned that 80 per cent of the world's patents are issued in the United States.

Two Types of Cutter Gangs Used in Milling Racks

ACCURACY in cutter manufacture is exemplified by the two gangs of cutters shown in Figs. 2 and 4. These cutters are used for milling racks in the manner illustrated in Fig. 1. While the saws or cutters combined in such a gang may number from fifty to several hundred, the individual limits of accuracy and the variation over the entire length of the gang are held to surprisingly small figures. For example, in the gang of cutters shown in Fig. 2, the limits on the dimension from one cutter to the next one are plus or minus 0.0005 inch, while with the gang of saws illustrated in Fig. 4 the limits on this dimension are only plus or minus 0.00025 inch. The limits specified for the total length of the cutter gang in both cases are plus or minus 0.003 inch. The cutters illustrated were produced by the Brown & Sharpe Mfg. Co., Providence, R. I.

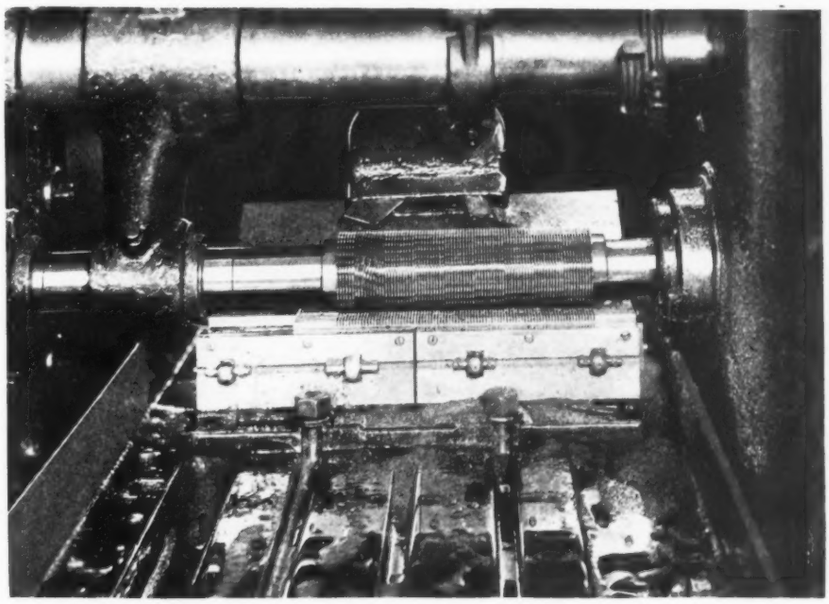


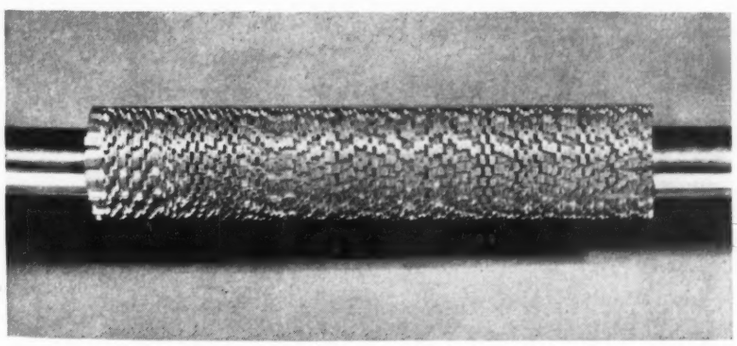
Fig. 1. Cutting 144 Teeth Simultaneously across a Rack by Employing a Gang of Saws Accurately Mounted on an Arbor

To obtain such a high degree of accuracy, considerable care must obviously be observed in the manufacture of the cutters and of the spacing collars used between them. After the cutters and collars have been made accurately to size, they must also be carefully assembled on their arbor.

The gangs of cutters shown in Figs. 2 and 4 are of noticeably different types. The one shown in Fig. 2, for instance, consists of individual cutters such as illustrated in Fig. 3. These cutters are accurately ground to the specified thickness and then butted together. The second gang, shown in Fig. 4, is composed of saws made up in groups or sections. The individual saws in the various sections are accurately spaced by means of collars, and all of the saws and collars of a section are fastened together by means of dowel-pins. These pins hold the sections together when they are disassembled for sharpening or for other purposes.

Both these types of gang-cutter construction offer certain advantages. Generally speaking, when it is necessary to disassemble cutter gangs, whether they are saws or form cutters, it is considerably easier, and much less expensive, to handle fifteen cutter sections, for example, than 150 individual saws or cutters. This ease of handling reduces sharpening costs and is an important advantage of the cutter gangs made up in sections.

However, the gangs made up of individual cutters have other advantages. For example, when the rack to be cut does not have straight-sided teeth, a form cutter must be employed, and such a cut-



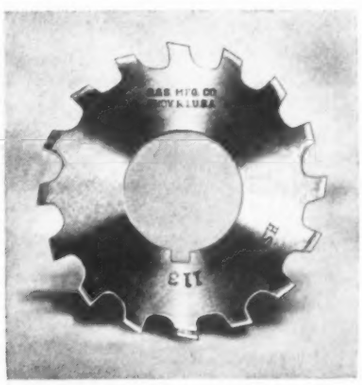


Fig. 2. (Above) Gang of Rack Cutters Made up of Formed Cutters Mounted Individually without the Use of Spacing Collars. Fig. 3. (Right) Formed Backed-off Cutter of the Type Usually Mounted Individually in Gangs, as in Fig. 2

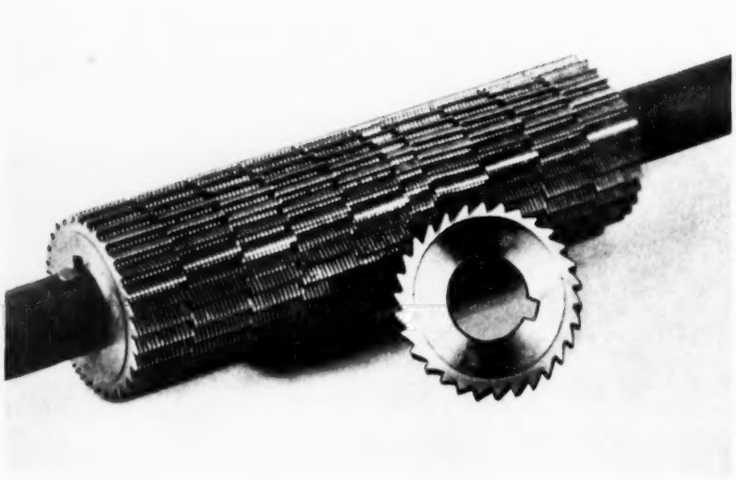


Fig. 4. Another Gang of Rack Cutters Consisting of Groups of Individual Saws and Spacers Doweled together

ter gives much more satisfactory results when used individually than when used in groups. This is due to the fact that individual cutters can be formed with the correct cutting clearances, which is not always possible when the cutter gangs are made in sections. Also, certain types of racks have tooth forms that can be produced only by using specially designed cutters, which must be assembled individually. Frequently, however, the individual cutters in a gang can be so designed that their teeth will form spiral flutes when the cutters are assembled on the arbor. Such a design enables sharpening of individual-cutter gangs at moderate costs.

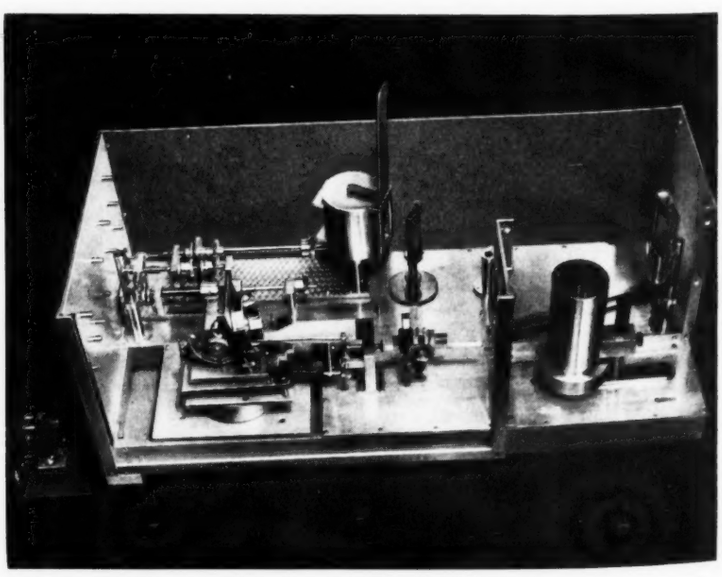
The tooth form of racks, therefore, imposes definite restrictions on the type of cutters used and, hence, on the gang construction. The production from gang cutters made up in either manner is about equal, so that the method to be employed really depends upon the tooth form requirements. Other things being equal, it is desirable to use the style that will be least expensive from the standpoint of handling, assembling, and sharpening.

Noteworthy Non-Accident Performances

With reference to the editorial on safety in the machine shop that appeared in February, 1938, MACHINERY, page 370, it may be of interest to note that at the end of 1937, the Westinghouse incandescent lamp manufacturing plant at Trenton, N. J., had completed 1,000,000 man-hours without a disabling accident, and that the plant at Bloomfield, N. J., had completed 1,500,000 man-hours without a similar accident. The Westinghouse wire products plant at Bloomfield, worked over 1,500,000 man-hours without a disabling accident from December, 1935, to October, 1937. This is almost three times the record of 573,000 man-hours completed on December 31, 1936, which was noted by the National Safety Council as the best record of any small plant during the year 1936.

* * *

Because a bronze plaque became so badly corroded that it was unreadable, nickel silver was chosen as the material for a marker to replace it at the spot where Generals Bolivar and San Martin met after their victorious campaigns for South American independence. This historic meeting took place in 1822 in Ecuador. Nickel silver was selected for the new plaque because it is believed that it will withstand the unusually destructive corrosive elements in the climate on the equatorial sea coast where the plaque is erected.



A Profilograph Installed in an Air-conditioned Room in the Laboratory of the Timken Roller Bearing Co. This Equipment is Used to Inspect the Surface of Highly Finished Machinery Parts, Ground, Honed, or Lapped. It Shows Surface Irregularities Magnified Five Thousand Times on a Piece of Paper Mounted on a Recording Drum

The Welding of Stainless Steel

Directions for Making Successful Fusion Welds in Stainless Steel, Based upon Information Obtained from the United States Steel Corporation Subsidiaries*—Second of Two Installments

Fig. 3. Gas-welding of Stainless Steel, Using Clamping Device and Copper Chill Plate Similar to that Illustrated in Fig. 1 (see February Installment of this Article)

IN the first installment of this article, published in February MACHINERY, page 383, general directions for the welding of stainless steel and for the electric welding of austenitic stainless steel were given. The present installment will deal with the welding of austenitic stainless steel by means of the oxy-acetylene flame and by the atomic hydrogen process. The welding of this steel to carbon steel will be referred to, and the annealing of welded parts will be covered.

Acetylene welding is used successfully on austenitic stainless steels, especially the lighter gages (U.S. No. 18-20 and lighter), and in certain cases where welding must be done in very confined spaces and short-circuiting might occur because of the length of the electrode; however, electric arc, or atomic hydrogen welding, where possible, is always to be preferred.

In welding thicknesses up to about No. 18 gage, flange type welds are ordinarily made without filler rod. Flanges are usually about 1/16 inch high, the excess material thus being fused and taking the place of the filler rod.

As the acetylene flame will spread heat farther than the electric arc, the use of chill plates or bars and clamping devices, as previously described, is very important. The flame should be as small as possible and blow-pipe tips one or two sizes smaller than customary for mild steel. Excess heat must be carefully avoided, as it will merely aggravate the tendency to buckle and warp. For normal austenitic stainless alloys, the best adjustment is to give an exactly neutral flame, but as this is difficult to maintain, a very slight excess of acetylene is advisable. The object is to prevent oxidation of the molten metal from the air by surrounding it with a non-oxidizing atmosphere. If too much acetylene is used, carburization of the weld takes place, making it hard, brittle, and lacking in corrosion resistance. On the other hand, with an excess of oxygen, the weld metal will become oxidized and porous and generally unsatisfactory. With proper adjustment for sufficient acetylene, the "feather" visible on the end of the inner blue cone should not be more than about 1/8 inch long. This provides sufficient excess acetylene to compensate for possible variations in pressure, and will insure solid welds without carbon pick-up.

Use of Flux in Acetylene Welding

Coated electrodes are not used in flame welding, but in some cases, the use of a flux improves welding operations and results in a smoother and better looking bead. While the flame protects the molten bead on the upper side against oxidation from the air, it cannot protect the under side. The flux, therefore, is applied to the under side close to the edges being welded. There are a number of commercial fluxes prepared especially for stainless steels, which may be used. The ordinary fluxes for brazing are not suitable. Fluxes are generally mixed with water to the consistency of thin paste and allowed to dry after application. Heat fuses

*The present article on the fusion welding of austenitic stainless steels is abstracted from the manuscript of a new book on the fabrication of stainless steels, just published by the United States Steel Corporation Subsidiaries, 434 Fifth Ave., Pittsburgh, Pa. The complete book can be obtained by application to the Corporation at the address given.

the flux so that it flows over and protects the under side of the weld, giving a smooth, neater appearing bead. Without flux, the bead tends to be rough, irregular, and more difficult to grind and polish. Flux may be applied to the top of the weld, as well as the bottom, and also on the filler rod itself, but in most instances, it will be sufficient if applied to the under side only.

Special attention is called to the fact that in welding titanium stabilized steels with columbium bearing welding rods, a highly infusible oxide is encountered. This oxide must be properly removed with a flux to obtain sound, clean, smooth welds. Special fluxes for this are on the market. The addition of 20 to 25 per cent cryolite to some of the commercial fluxes, mixed to a thin paste with water and applied to the electrode by dipping, will break up and make fluid any infusible slag resulting from the welding of titanium-treated material. With such fluxes, the flame should be very slightly oxidizing rather than reducing.

Actual Welding Procedure

As acetylene welding is generally restricted to light gages, small filler rod, 3/32 inch or under, is the rule, or thin trimmings from the edges of the sheets themselves may be used satisfactorily. Proper welding technique consists in holding the filler rod in such a position relative to the torch that it fuses simultaneously with the base metal and forms a complete union between the parts being welded.

Point the flame directly at the work, and hold the filler rod in the reducing portion of the flame to avoid its becoming oxidized. For if oxidation occurs, pin-holes in the weld metal are likely to follow. Torch manipulation should be restricted to a slight back and forth movement only along the seam. Avoid sidewise movement, as it merely spreads the heat and increases the possibility of buckling and distortion.

In all welding, and it is particularly important with acetylene welding on account of the greater dispersion of heat, the quicker the welding can be performed with the least possible heating of the adjacent metal, the better the results and the less the distortion and buckling.

If jigs and clamps are not available, the joint should either be butted together straight for heavier sheets, or flanged slightly for light sheets and strip, as noted in the foregoing, with the flux applied to the bottom side. The joint should be tack-welded about every 3/4 inch on sheet gages. It may then be realigned and welding completed the same as if held in a jig. Without clamps, some buckling may occur, but if care is used to avoid excess heat and the welding is done rapidly, a fairly satisfactory job should result. Hand backing with a copper chill bar is advisable.

Acetylene welding can be successfully used for heavier gages than No. 16, provided proper jigs and clamps are used to prevent buckling. Gages heavier than No. 7 should be scarfed, as for electric arc welding. Puddling is strictly to be avoided, and the weld once started should be finished as rapidly as possible.

Atomic Hydrogen Welding

The atomic hydrogen process is useful for welding light-gage sheets and strip. The finished weld is usually quite smooth and requires less labor in grinding and polishing than some other types of welds. The process depends upon the utilization of the intense heat developed when atomic hydrogen, which has been dissociated from molecular hydrogen by an electric arc formed between two tungsten electrodes, recombines to molecular hydrogen. Both calculation and experiment indicate that the temperature reached is considerably higher than that of the oxy-hydrogen or the oxy-acetylene flame

Atomic hydrogen welding is defined as an alternating-current arc-welding process wherein the heat is obtained from an arc produced between two suitable electrodes in an atmosphere of hydrogen. The quantity of heat in the atomic hydrogen flame can be controlled within reasonable limits, and within the range of penetration possible (not exceeding No. 12 gage for large burners), the process is very satisfactory.

Filler rods are not necessary with light gages, but may be used if desired. Fluxes are generally not used. In the atomic hydrogen stream, the heat is concentrated more than with the acetylene flame, and is actually more intense. It is still necessary, therefore, to use clamping jigs and fixtures. Difficulties from carbide precipitation, while less than with acetylene welding, are not avoided and must be taken care of by the methods already discussed. As in any type of fusion welding, the work should be completed as rapidly as possible.

A magnetic cut-off, which will close the gas valve if the arc breaks, will avoid waste of hydrogen and reduce the cost of operation.

Welding of Austenitic Stainless Steels to Carbon Steels

The question is often presented as to the possibility of joining stainless to mild or carbon steel by welding. This can be done successfully by either the electric arc or the gas welding process, the former being preferred.

The welding of galvanized steel, or tin- or terne-coated steel to stainless steel, is not recommended, however, unless the coating is completely removed prior to welding. The welding of stainless steels to galvanized steel results in a very peculiar intergranular penetration of the stainless steel and cracking of the stainless steel weld metal or base metal or both. Sometimes these cracks may run for inches. Visual methods cannot be relied upon to determine whether or not galvanizing has been completely removed. This must be checked by a chemical indicator, such as a dilute acid plus an inhibitor.

Tests have shown that only stainless electrodes and filler rods should be used when welding stainless to carbon steel. The welding procedure is the same as described in this and the preceding article on gas and electric welding.

Inasmuch as a lowering of the chromium and nickel content must take place by admixture of mild steel, the weld metal may become air-hardening, and for the same reason, deficient in corrosion resistance.

By altering the position of the welding rod, it is possible to regulate its fusion, and hence, the proportions of chromium and nickel that are fused with the mild steel. The more the rod approaches the perpendicular, the less will it be melted.

In the case of long lengths of stainless steel to be welded to mild steel, it should be remembered that the coefficient of thermal expansion of austenitic steels is about 50 per cent greater than that of mild steel, and if the welded part is subjected to changes in temperature, buckling and distortion will probably take place, due to unreleased stresses from differential expansion.

Annealing After Welding

Annealing austenitic stainless steels after welding is advisable for two reasons: (a) Relief of strains set up through differential expansion and contraction; (b) solution of carbides, except where stabilized with titanium or columbium.

The annealing of these steels, which accomplishes both relief of stresses and solution of carbides, is done at high temperatures and must be followed by rapid cooling. For "18-8" and "19-9" stainless steels, heat in the range 1850 to 2000 degrees F., depending on the section, heavier sections requiring higher temperatures. It is not necessary, nor advisable, to hold at these high temperatures for an extended time, but the piece must be thoroughly and uniformly heated. Heavy sections should be preheated around 1400 to 1500 degrees F. until thoroughly soaked, then raised rapidly to the higher temperatures.

If the steel welded is low-carbon—0.06 per cent or under—carbide precipitation, even at maximum, will be slight and may be disregarded, so that annealing will not be necessary unless the service is highly corrosive. If the carbon content is higher, annealing may, or may not, be necessary, as the service is severe or moderate. Much equipment has been fabricated from 18-8 with 0.11 or 0.12 per cent carbon, and this has given excellent service in mildly corrosive surroundings. For severe service, annealing is always advisable, except where the presence of titanium or columbium eliminates danger of intergranular corrosion.

For "18-8 Mo." stainless steel, heat to 1950 to 2000 degrees F., and cool as rapidly as possible. Rapid cooling after annealing is particularly important with this steel.

If large structures, such as tanks, etc., are to be annealed at high temperatures, some form of internal support or bracing may be necessary to prevent change of shape through distortion or sagging. How this should be accomplished will depend upon the shape of the piece itself.

Rapid Cooling is Essential to Successful Annealing

The rapid cooling of austenitic steels after annealing is of utmost importance. Carbides are precipitated whenever the steel is heated in the range of 900 to 1500 degrees F., whether held in this range or cooled slowly through it. Hence, there is a necessity for rapid cooling, and this cannot be over-emphasized. Cooling of the steel from high heat to black should be complete in sixty seconds maximum.

To accomplish this, water quenching is desirable and should be employed for all sections 3/16 inch and heavier. When quenching in a large volume of water is not possible on account of the shape or size of the piece, water sprays may be used. The number and arrangement of these will depend, again, on the character of the job. The important points are that the supply of water be ample, and that sufficient pressure be available to prevent the formation of a steam-blanket that might retard cooling.

Stabilized austenitic steels, that is, those containing titanium, columbium, or a similar stabilizing element, may be stress-relieved by heating to moderate temperatures. This consists of heating to 1550 to 1650 degrees F. and holding at this temperature on a basis of one hour per inch of section, with a minimum of two hours holding time. Annealing at very high temperatures is not necessary for these steels unless maximum ductility and softness is required. In such cases, heat to 1850 to 2000 degrees F. and cool in air to the stabilizing temperature. Hold as per instructions given above and cool slowly.

* * *

Machine and Tool Progress Exhibition in Detroit

The exhibition sponsored by the American Society of Tool Engineers, to be held in Convention Hall, Detroit, Mich., March 9 to 12, in connection with the Society's first annual convention, promises to be an outstanding event. More than a month ahead of the opening of the convention it was announced that over a hundred exhibition spaces had already been definitely assigned, and additional space, beyond that originally planned for the exhibition, was made available.

* * *

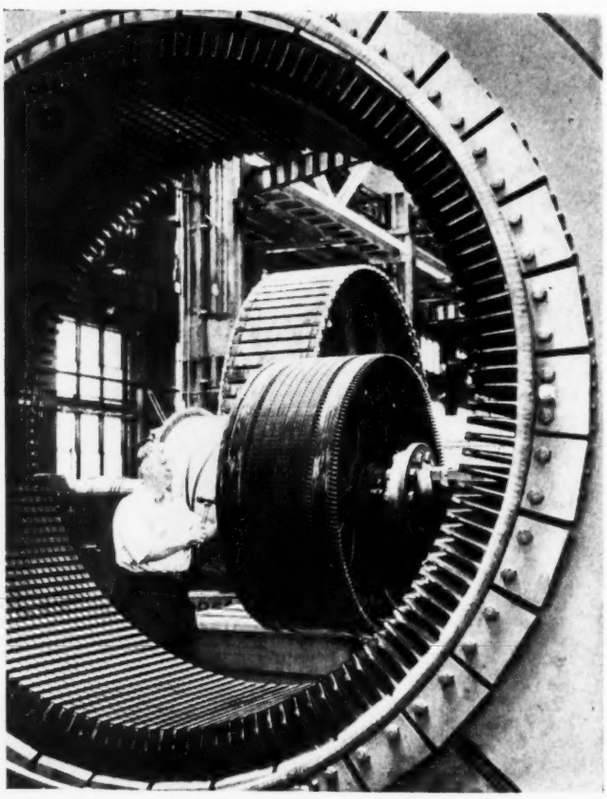
There are still a great many old-fashioned individuals in this country who believe that the American people can attain the things they want in life more quickly through real work and serious effort than they can through law-making.

Engineering News Flashes

The World Over

Boiler Operating at 2500 Pounds per Square Inch

To meet the demand for boiler equipment designed to withstand increasingly high temperatures and pressures, the Clees Valve & Engineering Co. is installing a new boiler in its testing laboratory at Newark, N. J., to provide steam at a pressure of 2500 pounds per square inch. This testing equipment supplements that previously available for supplying steam at 1500 pounds per square inch, and hydraulic facilities for testing pressures up to 10,000 pounds per square inch. The new testing equipment will make it possible to determine with certainty how the boiler will perform under actual operating conditions. The equipment will also be used in testing recently developed types of forged-steel valves, some of which have been designed to withstand pressures up to 2500 pounds per square inch. Such valves are now being produced in sizes up to 8 inches. Only a short time ago 2 1/2 inches was the maximum size for forged-steel valves.



Lining up the Leads on a Large Direct-current Armature in the Schenectady Works of the General Electric Co. This Work Requires Thorough Knowledge of the Methods Used in the Manufacture of Large Rotating Machinery. A Large Field Structure in the Foreground Makes an Unusual Frame for the Picture

How the World's Nickel Production is Used

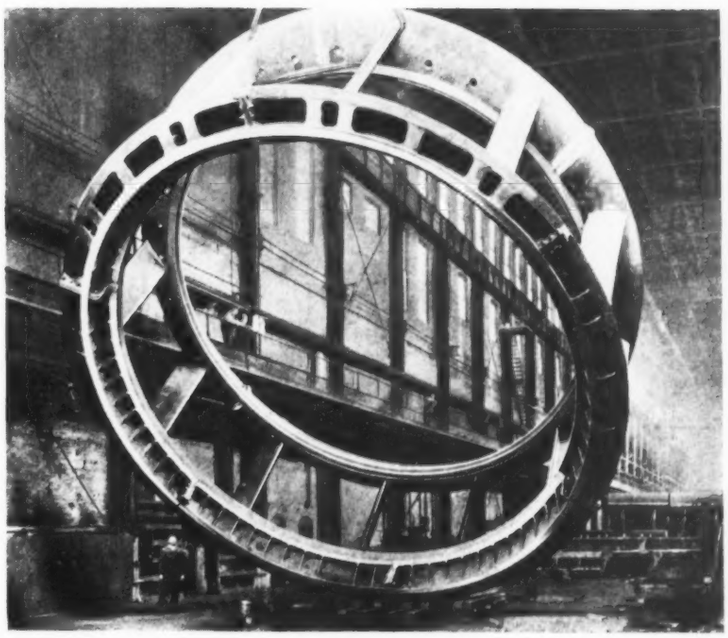
The world's nickel consumption in 1937 attained a total of approximately 115,000 tons, of which 55 per cent was used for alloy steels of all kinds, including structural, stainless, and other corrosion- and heat-resisting steels, and steel castings. Five per cent was used in nickel cast iron, and one per cent in other nickel-iron alloys. About 10 per cent was used in nickel-copper alloys and nickel silvers, while Monel, malleable-nickel, nickel-clad metals, and Inconel accounted for 12 per cent. Ten per cent of the total nickel was used for plating or electro-deposition, the remainder being used for miscellaneous alloys.

Fourteen-Foot Diameter Gears Used in Ship Propulsion

In the new *Mauretania* of the Cunard-White Star Line, now being built in England, two giant gears will transmit the power from the turbines to the propeller shafts. The gears are approximately 14 feet in diameter and are provided with 500 teeth. These are the largest gears that have ever been applied to ship propulsion. They exceed in size those used on the *Queen Mary*. The *Mauretania* will be launched in July, this year, and is expected to be ready for service early in 1939.

Electric Generator Gives Forty-Seven Years of Service

In 1890, the Thomson-Houston Co., a forerunner of the General Electric Co., built and installed an electric generator for the Indianapolis street railways. It was the first generator used to furnish electric power in that city. This generator has been in use almost constantly since that date until late last year. It was removed because the build-



Assembled Cast-steel Speed Ring for One of the Two 55,000-horsepower Hydraulic Turbines Constructed by the Allis-Chalmers Mfg. Co., Milwaukee, Wis., for the Pickwick Landing Project. The Photograph, Showing Partially Machined Bottom Flanges, was Taken Just as the Piece was being Turned Over for Machining the Top Flanges. This Speed Ring, Cast in Six Sections, has an Outside Diameter of Over 37 Feet, and an Over-all Height of Nearly 15 Feet. It Weighs 250,000 Pounds

ing in which it was located had to be razed to make way for a new transportation building of the Indianapolis Railways. Even after forty-seven years of service, the machine is still in running condition.

A Giant Coal Car Dumper

A coal car dumper built by the R. W. Kaltenbach Co., constitutes an outstanding example of modern coal-handling methods. This car dumper, provided with General Electric equipment, is capable of handling, on an average, fifty 120-ton coal cars an hour. The electrical equipment is designed to handle the full capacity of the car dumper on a continuous basis. The dumper lifts and turns over each car in unloading the coal. It is practically automatic in operation, the human element having been eliminated wherever practicable. An elaborate system of limit switches governs the movements, guarding all drives from possible damage. Two 500-horsepower motors furnish the power for operating the equipment. Floodlights are provided directly on the equipment for night operation.

World's Water Power

From the water power statistics of the World Power Conference in 1936, and from figures published by the United States Geological Survey, the rapid progress of water power developments is in evidence. The total water power installations in 1920 equalled 23,000,000 horsepower. In 1936, this figure had risen to 60,000,000 horsepower. Of this, 17,000,000 is being utilized in the United States and 8,000,000 in Canada. Italy has developed 6,000,000 horsepower, France over 5,000,000, and Norway and Switzerland each close to 3,000,000. The total development in Europe reaches 26,000,000 horsepower.

It is also of interest to note what are the complete water power resources not yet developed in various countries. These resources are estimated at 33,500,000 horsepower for the United States, and 25,500,000 for Canada. Norway possesses 16,000,000 horsepower in undeveloped resources, and Soviet Russia in Europe, 14,000,000. All together, there are 58,000,000 horsepower undeveloped in Europe. Obviously, immense undeveloped resources are also available in Asia, South America, and Africa.

Bending Pipe by the Aid of the Oxy-Acetylene Flame

In overland pipe line construction, an unusual method of pipe bending has been developed known as "wrinkle bending." At the point of the bend, the blowpipe is used to heat one or more narrow bands at right angles to the axis of the pipe and extending about half way around the pipe. The pipe is bent a small amount as each band is heated, and the heated sections, which are on the inside of the bend, wrinkle up to permit the bending of the pipe. With large pipes, two blowpipes are used for the heating operation.

Diesel Locomotives in High-Speed Passenger Service

The tremendous growth of Diesel engine main-line train service during the last couple of years is best indicated by the fact that today, in the United States, Diesel locomotives in high-speed passenger service cover more than 20,000 miles a day. Some of these locomotives have traveled more than half a million miles without requiring major overhauling.

Meehanite Cast Iron—A Metal of Unusual Properties

Recent Developments in the Metallurgy of Cast Iron have Made Possible the Production of Castings Having Properties Far Superior to Those Obtained in the Past

MORE than twenty years ago, Oliver Smalley, a well-known English metallurgist with a considerable foundry background, foresaw a large commercial market for iron castings of superior properties and dependability. His investigations were recorded in a number of papers read before engineering societies. Following certain of Mr. Smalley's technical publications on this subject, G. F. Meehan, of Chattanooga, Tenn., a foundry owner, communicated with Mr. Smalley and informed him that he also had been working along similar lines.

Mr. Meehan had obtained definite results in making improved castings—results the reasons for which Mr. Smalley with his scientific experience was in a position to give. Furthermore, with the knowledge of the metallurgical causes, it was possible to repeat the results at will and further advance the developments. In 1928, Mr. Smalley and Mr. Meehan joined forces and patented the results of their research. Since Mr. Meehan had made some of the earliest practical applications, revealing certain definite novel characteristics, the name Meehanite metal seemed appropriate. A company was formed to supply the growing demand for this high-duty type of cast iron.

Mr. Meehan died shortly after these plans had been formulated, but the further development of both the product and the company, now known as the Meehanite Metal Corporation, with headquarters in Pittsburgh, Pa., was continued under the presidency of Mr. Smalley. A large number of foundries, both in this country and abroad, are now licensed to make Meehanite iron, and the Meehanite Research Institute was later formed to enable all licensees to pool their development problems and to contribute to the further advancement of the art.

What Is Meehanite?

The basic methods in the manufacture of Meehanite metal are similar to those used for cast iron and semi-steel in that the basic materials employed are pig iron, foundry scrap, steel scrap, coke, and limestone. The cupola, however, is of a more modern design, and the method of melting is under strict metallurgical control. The basic materials are selected in such a manner that the final product will meet definite and rigid specifications according to the service conditions. An analysis of the final product is of little value in forecasting either the mechanical or the physical characteristics. Just as it is possible to have a type of tool steel of similar analysis to cast iron, but having totally different physical characteristics, so it is possible to have equally marked differences in the characteristics of Meehanite metal and of cast iron of the same analysis.

Nevertheless, the metallurgical control in the production of Meehanite metal must be so accurate that a liquid metal test, taken from the ladle while under the cupola spout and cast into proper form, will give an immediate index of the properties of the metal, and, if necessary, the liquid metal can be modified before casting. This control of the liquid metal is such that every ladle can at any time be exactly repeated.

For general engineering applications, Meehanite metal is made in five different types, known as A, B, C, D, and E. These types vary in tensile strength from 30,000 pounds per square inch for the E grade to 50,000 pounds per square inch for the A grade. By heat-treating the A grade, a tensile strength of 75,000 pounds per square inch can be obtained.

Physical Properties of Meehanite Metal

In addition to improved tensile strength, Meehanite metal has many other unusual physical characteristics. It is "non-growing" at high temperatures, and offers a high resistance to abrasion, erosion, and corrosion. Its soundness and reliability are marked, and Meehanite castings are uniform and freely machined.

It is well known that in ordinary gray-iron castings in which there are marked changes in section, the lighter sections are often hard and difficult to machine. This difficulty has been overcome in Meehanite where heavy and light sections have uniform machineability. Other valuable properties of Meehanite metal are its high modulus of elasticity and excellent dampening properties, characteristics that are useful in highly stressed machine tool parts, power press frames, and steam and Diesel engine castings. Again, this high dampening capacity is a useful property in crankshafts and gears,

to assure absence of vibration and quiet running. The metal also work-hardens on the surface and does not spall or gall, another reason why it is useful for heavy-duty as well as precision parts. It has also been applied in the automobile industry for cast camshafts and crankshafts, as well as for other castings.

The density of the metal, that is, its pressure tightness, has made it of value in laundry machinery—for steam drying and pressing machines—where castings must be impervious to high-pressure steam. The metal acquires a high degree of polish, and can be readily chromium-plated, as well as finished by other protective surface finishes.

Applications to Hydraulic Equipment

One application in which the metal has been found of particular value has been for the cylinders and rams of hydraulic presses used in forging, pressing, or deep drawing work. Because of the occasional overloads to which they are subjected, castings for these services are severely tested. The combination of high-pressure resistance and the ability to take a mirror-like finish in the bore of cylinder castings has made this material well suited for hydraulic cylinders used in the operation of modern machine tools.

The resistance to growth of Meehanite under either continuous high temperatures or alternating high and low temperatures has established it as an essential material in many industrial furnace and high-temperature applications.

In pumping machinery in gravel, cement, mining, crude oil, and chemical plants, the ability of this metal to resist abrasion and corrosion is one of its most valuable characteristics. It is, therefore, extensively used in these fields, and has greatly increased the life of the equipment used. Its resistance to abrasive action is also illustrated by its greater life when used in cement ball mills, concrete mixers, and the like. It is also used for conveyor chains, dredger bucket lips, and similar applications.

The Application of Meehanite to Dies

The wear resisting property of Meehanite has given it an important place in the making of dies for forming, pressing, drawing, and stamping metal. By virtue of its hard, tough, and dense structure, the metal does not crush at its edges nor deform or gall, but, on the contrary, work-hardens on the surface, acquiring a glazed skin which greatly increases the life of the die. Since the metal can be cast to form with a good skin finish, the cost of machining is reduced, and a relatively long life makes the use of dies from this metal most economical for many purposes. Automobile fenders, for example, are made in Meehanite dies, but the metal is also applied to small dies of practically every description. In one instance on record, the die for a cold-rolled steel pan with rather a deep draw has been used for 350,000 pieces without refacing, and is still in good condition. Automobile fender and body dies have been used for 120,000 parts and are still in service.

The preceding paragraphs give a general idea of the broad application of Meehanite in the machine-building industries, furnishing a conception of the properties of the metal and the service that it is capable of giving.

* * *

Welded Export Crates

By JOHN E. HYLER

The difficulty of boxing and crating heavy machines for export is well known to every manufacturer of such equipment. One way of solving this problem that has been used with considerable success has been by the use of the "box within a box" method, one box being so made as to snugly fit the other, and the lumber of the two boxes being so arranged that the grain would cross on all sides. This method, with proper bracing, produces a very strong job.

Another method that has been employed recently and has given good results in the case of machines that are both heavy and bulky is to use relatively light structural steel members for the crate. R. G. LeTourneau, Inc., Peoria, Ill., builder of heavy grading machines, has exported a considerable number of machines in crates made up chiefly of small I-beams welded in place. The crates are carefully laid out in the engineering department to show just what material is needed and how it is to be fitted together. When desirable, heavy wood spacing or bracing members can be bolted into the crate, but in most cases, such bracing has been found unnecessary, welded braces meeting all requirements.

* * *

Apprentice Contest in Molding and Patternmaking

The American Foundrymen's Association announces that the molding and patternmaking contests, which have met with such success in past years, will be held again in connection with the 1938 convention in Cleveland, during the week of May 16. The contest is sponsored by the Association's Committee on Foundry Apprentice Training. Competitions will be held in steel molding, iron molding, non-ferrous molding, and patternmaking. Substantial prizes will be awarded. Copies of the regulations can be secured by writing to the American Foundrymen's Association, 222 W. Adams St., Chicago, Ill.

* * *

The price of progress is trouble.—*Charles F. Kettering*

Everybody Knows

That with the sudden decline in business that has taken place during the last few months unemployment has increased by leaps and bounds.

That the one job before Congress, of vital importance to the whole nation, is to stop the disastrous spread of this decline.

That while several things are wrong which cannot all be corrected at once, a start must be made somewhere; if we do not get started soon, it may be too late.

That the Administration and Congress are both pledged to aid business recovery and promote employment; and that in recent months they have signally failed to accomplish this avowed purpose.

That although faced with this urgent need, Congress has been in session nearly two months without having taken a single constructive step toward the restoration of business confidence and the stimulation of business recovery.

But How Many Know

That instead of encouraging employment, the Government, through sponsoring the Undistributed Profits Tax, has been the direct cause of widespread unemployment.

That companies that spend any part of their earnings for increasing or maintaining employment, by providing additional manufacturing facilities, are punished by the imposition of a heavy penalty tax.

That reports from representative concerns in the mechanical industry show the Undistributed Profits Tax to be the direct cause for stopping $90,000,000 worth of equipment buying.

That this indicates an enormous stoppage of buying in all the Durable Goods Industries, of which the machine shop industry represents only about one-tenth.

That the repeal of the Undistributed Profits Tax would encourage the buying in the immediate future of nearly 60 per cent of this enormous volume of equipment, thereby creating employment and re-establishing business confidence.

"If you, as a manufacturer, spend any part of your company's earnings for new plant, new machinery, or tools to provide facilities for the employment of more men, the Government will impose a heavy penalty tax." That, in effect, is what the Government says to manufacturers who contemplate spending some of their corporate earnings for the erection of new buildings and for the purchase of new equipment that would directly or indirectly create jobs for more men. The Undistributed Profits Tax means just that.

How Government Fines Manufacturers Using Profits to Make Jobs

It seems hardly credible that an Administration pledged to reduce unemployment should penalize the very action necessary to sustain employment. Yet this is what the Government is actually doing. This statement is not based on mere opinion. MACHINERY has conducted a widespread inquiry among the machine-using plants throughout the country—large, medium, and small. The result of this inquiry reveals the Undistributed Profits Tax to be the chief cause for deferring, during the last six months, equipment buying in the mechanical industry amounting to approximately $90,000,000.

In detail, the results of the inquiry are as follows: 120 firms state that the Undistributed Profits Tax has been the *principal reason* why they have considered it inadvisable, within the last six months, to place orders for new equipment valued at over $10,200,000. Assuming that the experience of these companies is duplicated throughout the entire machinery industry—a fair assumption since these plants are representative of the industry as a whole—it is conservatively estimated that $90,000,000 worth of machine equipment would have been bought and made within the last six months, if manufacturers had felt that they could have afforded to pay the heavy penalty tax in addition to the purchase price of the equipment.

Furthermore, the inquiry indicates that if the Undistributed Profits Tax were promptly repealed, 58 per cent of this contemplated equipment would be placed on order in the near future.

The indirect effects of repeal would be even greater than estimated. In a report made to the President in 1934 by the Durable Goods Industries Committee, after an extensive study of the problem of unemployment, it was pointed out that for every ten men employed in the manufacture of durable goods, nine men are employed in services and transportation; and as the raw materials of durable goods originate in the mines, forests, and farms, it is equally clear that the stoppage or starting of employment in the Durable Goods Industries has far-reaching effects on employment in almost every line of work.

Employe is Hurt as Much as Employer by This Tax

It is not surprising, therefore, that a penalty tax such as the Undistributed Profits Tax should have had such a paralyzing effect upon business, industry, and employment. If the workers in industry realized what this tax has done to them, and what it is doing in causing unemployment, there would be a tremendous clamor from labor for its repeal.

It is the duty of Congress to act at once. This is not a measure that can be corrected by modification; it is based on a fundamentally wrong principle, and the only way to correct it is by complete repeal.

Ingenious Mechanical Movements

Mechanisms Selected by Experienced Machine Designers as Typical Examples Applicable in the Construction of Automatic Machines and Other Devices

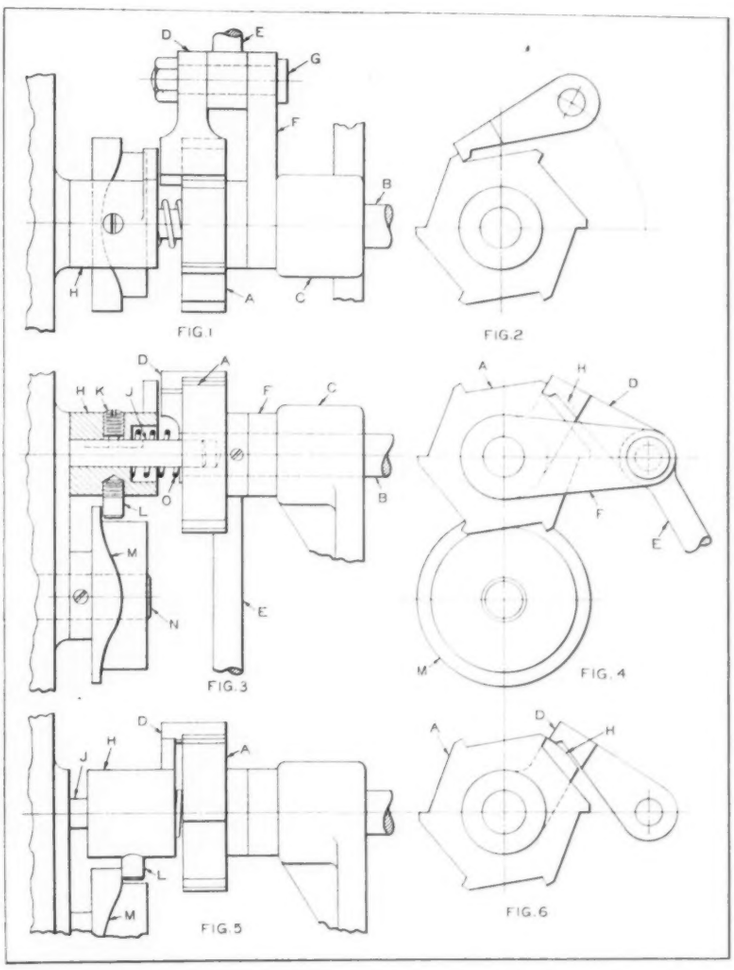
Ratchet Mechanism with Device for Controlling Engagement of Pawl

By JOSEPH WAITKUS

A rather novel method of controlling the action of a pawl on a ratchet is incorporated in the ratchet mechanism shown in the accompanying illustrations, Figs. 1 to 6. In the particular application for which this mechanism was developed, the ratchet is required to operate at a slow and uniform rate, and at periodic intervals to skip one or more movements of the ratchet.

The ratchet wheel *A* is mounted on a shaft *B*, which, in turn, rests in a bearing *C*. The pawl *D* forms a part of the operating unit, which consists of the actuating rod *E*, connected to the upper mechanism, and the bar *F*, which serves to keep the ratchet and pawl in the same relative positions throughout their movements. A stud *G* holds the three members of the operating unit together. The pawl control unit consists of a displacing collar *H* which has a sliding fit on the pin *J*. The key *K* slides in a keyway in the pin *J* and serves to keep the member *H* in a fixed position relative to ratchet *A*. A cam follower *L* makes contact with the surface of the cam *M*, which is fastened to a shaft *N*. Spring *O* tends to keep the displacing collar *H* away from ratchet *A* and at all times under the action of cam *M*. To properly align the ratchet mechanism and displacing collar, the pin *J* is extended into a hole in the end of shaft *B*.

In Fig. 4, the pawl is shown in position ready to rotate the ratchet through a distance equivalent to one tooth space. Fig. 2 shows how the pawl travels through an arc determined by the length of bar *F*. In Figs. 1 and 2, the position of member *H* is as shown in Fig. 3, where it will be noted that the cam follower *L* is at the lowest point of the cam surface and the displacing collar is away from the ratchet. Fig. 5 shows the cam rotated to the position where follower *L* has caused member *H* to be moved forward toward the ratchet. The result is shown in Fig. 6, where it will be seen that the pawl has been raised, to prevent it from coming in contact with the next tooth, thus interrupting the ratchet movement.



Figs. 1 to 6. Diagrams Showing Ratchet Mechanism with Cam Arrangement for Disengaging Pawl

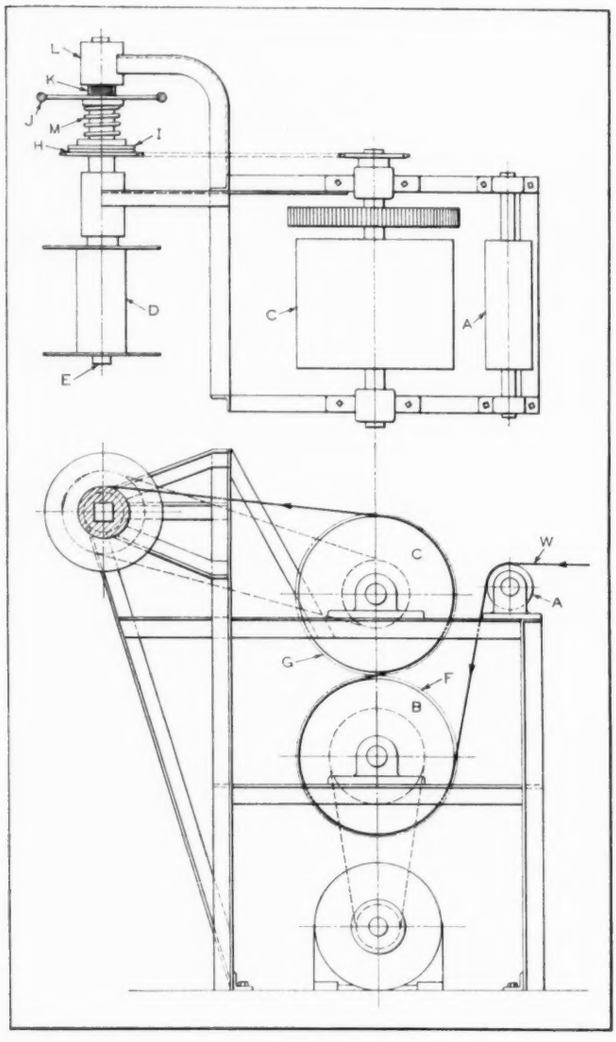
The cam *M* can be arranged to provide any form of interrupted ratchet motion desired. It can be arranged to rotate continuously or intermittently, depending upon the nature of the application. The cam action is so timed that member *H* is moved forward into position to prevent the pawl from engaging the ratchet wheel at the moment the pawl is in the position shown in Fig. 2.

Constant-Speed Drive for Winding Metal Strips

By RAYMOND O. KRENGEL

Certain classes of metal strip material, after being put through various cleaning processes, are wound on steel spools mounted on a revolving shaft. The diameter of the spool hub, on which the metal is wound, is usually 6 inches. The spools were originally driven at a speed of 100 revolutions per minute. With this arrangement, the surface speed at the beginning of the winding operation was about 150 feet per minute. As the coil of metal became larger diametrically, the surface speed increased proportionately. The result was that by the time the full length of metal had been wound around the spool, the surface speed had been increased about 100 per cent. This increase in speed resulted in scratched stock, which frequently had to be rejected.

As the processing operations required certain speeds for best results, it was necessary to maintain a constant winding speed. To meet these requirements and to overcome previous difficulties, the constant-speed pull-roll unit shown in the illustration was built. This unit consists primarily of two large rolls *B* and *C*, driven at a constant speed and mounted one above the other on suitable bearings in an all-welded frame of standard structural steel. This unit also contains a square-ended revolving shaft *E*, mounted in bearings located on the outside of the main frame. The steel winding spool *D* slips over shaft *E*, the square end of which drives the spool.



Constant-speed Rolls for Pulling Metal Strip through Processing Machine and Winding it on Metal Spool

As the metal strip *W* comes from the processing machine, it passes over the guide roll *A*. From roll *A* it passes under and half way around the pull-roll *B*, thence upward and half way around the pull-roll *C* to the winding spool *D* on the shaft *E*. From the illustration it will be noted that there is a small space between the pull-rolls. This space is necessary to allow the joints of the material to pass between the pull-rolls.

The unit is driven by a chain from the motor located below the pull-rolls, spur gears *F* and *G* transmitting power from one roll to the other. From pull-roll *C* a chain drives the winding spool *D* through friction disks *H* and *I*. More or less friction is obtained by turning handwheel *J* on the threaded bronze sleeve *K* which fits over the main shaft and is fastened to the rear bearing *L*.

As handwheel *J* is moved either clockwise or counter-clockwise, the compression spring *M* increases or decreases the pressure on the friction disk *I*, so that the desired tension is maintained on the metal being wound. Thus the speed at which the metal is wound on the spool remains constant no matter what the diameter of the coil may be, the slipping that occurs between the friction disks compensating for the difference in speed. The rolls *B* and *C* do all the pulling of the metal through the processing machine and they also regulate the speed of the machine and govern the winding spool speed.

Cam-Controlled Variable-Speed Drive

By A. A. NEFF

By properly proportioning the four gears and cam that constitute the important parts of the drive shown in the accompanying illustration, it can be caused to give any one of a great variety of speed actions, the simplest of which may be described as an intermittent or stop motion. When designed as a stop motion, it can theoretically perform this action in any one of a variety of ways. The ratio of the period of stop and the period of motion may be of any arbitrarily chosen value.

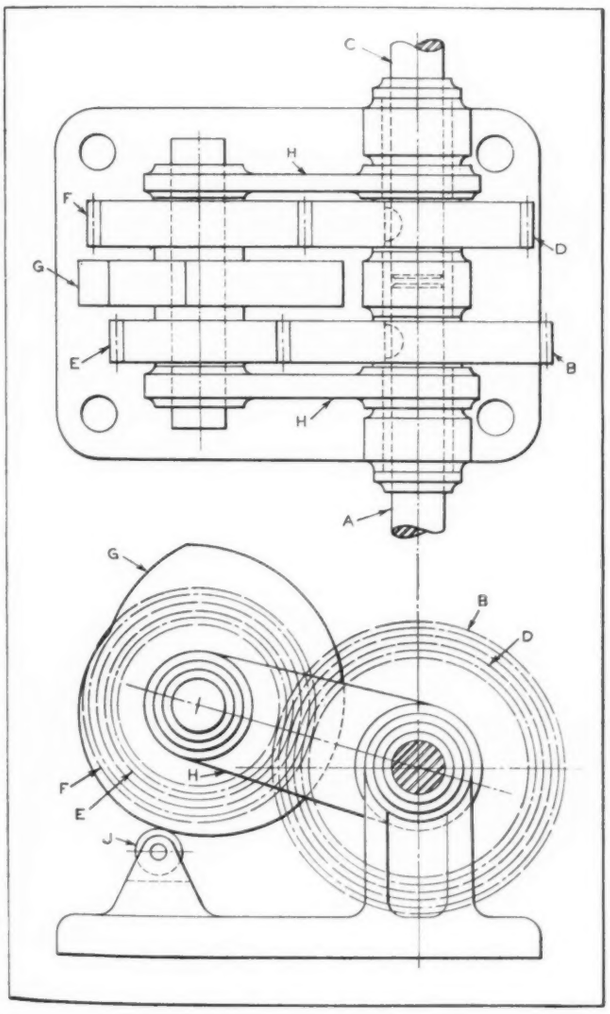
The number of stops per revolution may be either fractional or integral. To some degree, the stop intervals may have a non-uniform or non-periodic sequence. The action, instead of being the usual

total arresting of motion, may also consist of merely a slowing down of the speed or it may be even more than a total stop—that is, it may be a momentary reversal of the motion.

The illustration shows a simple but general arrangement of the device. The drive-shaft is shown at *A* and the driven shaft at *C*. Gear *B*, keyed to shaft *A*, drives gear *D*, keyed to shaft *C*, by means of back-gears *E* and *F*. At *G* is a cam that revolves as a unit with gears *E* and *F*. The frame *H* of the back-gear is a rigid unit, but pivots or is free to oscillate about the common axis of shafts *A* and *C*. The frame *H*, with its gears and cam, rests on the cam-roller *J*.

The gears *B*, *E*, *F*, and *D* constitute a train that may have any desired driving ratio within certain limits other than unity; that is, the ratio of *B* to *E* must not be the same as *D* to *F*. The action of the mechanism is as follows: The cam *G* rotates with the gears *E* and *F*, and as it rides on the roller *J*, its undulating contour gives a rocking motion to the frame *H*, which impresses a motion on the rest of the mechanism, in addition to that given by the driving shaft *A*. Thus if shaft *A* is held stationary, a movement of *H* will cause *C* and *D* to turn in one direction or the other, since the train value is not unity.

On the other hand, if cam *G* is lifted free of the roller *J*, and *H* is held stationary, the only motion that *A* can impart to *C* will be that transmitted by the gear train *B*, *E*, *F*, and *D*. Thus the motion of *C* due to that of *H* can be combined with that due to *A*, either positively or negatively, with the consequence that the motion of *C* results at one time from the sum of the two motions of *A* and *H*, and, at another time, from the difference of the two motions. By giving the proper value to the gear train *B*, *E*, *F* and *D*, and the proper contour to the cam *G*, any one of the actions mentioned can be obtained.



Variable-speed Drive from Shaft A to Shaft C with Variation in Speed Obtained by Cam G

* * *

Large Plant Expenditures Indicate Business Confidence

A program of plant expansion, involving expenditures of $11,000,000 during 1938, has been announced by the Sun Oil Co., Philadelphia, Pa. These expenditures will be made chiefly in connection with the company's two main refineries at Marcus Hook, Pa., and Toledo, Ohio. The improvements will not only increase the capacity of the present plants, but will also adapt them to important new refining processes.

In announcing this program, J. Howard Pew, president of the company, said: "The fact that the company is entering upon this expansion program at this time is evidence of our confidence in the basic soundness and permanence of the American competitive system of economics and our institutions of democratic government, notwithstanding certain temporary political trends, which if long continued, would inevitably lead to industrial disaster. Business and industry are the real sources of employment and guarantors of prosperity. We believe there should be no interruption of the continuous modernization and improvement of plants, equipment, and technical processes."

* * *

New Industrial Motion Picture

How valves and fittings make it possible to control the flow of liquids and gases is explained in a new sound picture produced by the Crane Co., Chicago, Ill. The picture is entitled "Flow." It consists primarily of a tour through the Chicago Works of the Crane Co., where the various steps in the manufacture of valves are shown—valves varying in size from the enormous giant types used in hydro-electric developments to small faucets used in the home. Scenes are also shown in the foundry and the forge shop, and the testing and research activities are given due attention—in fact, the film gives a very complete conception of all that is involved in valve manufacture.

Improved Method of Making Quills for High-Speed Spindles

By JAMES M. HAMILTON
Assistant Production Manager
The Dumore Co., Racine, Wis.

CHANGES can frequently be made in the design of a part and in the manufacturing methods by which it is produced that will improve the quality, and at the same time, greatly increase production rates. The quill tubes that carry the spindles of Dumore portable precision grinders were formerly made of cast iron by methods that were accurate but slow. Today they are made of steel by a manufacturing set-up that has speeded up production and also increased the accuracy of the part appreciably.

The quill tube is a highly important part in the construction of a portable precision grinder, because smooth, accurate grinding at speeds up to 42,500 revolutions per minute (700 revolutions per second) depends, to begin with, upon an accurate spindle quill. Inaccuracy in a quill tube will be picked up and amplified by the grinding spindle, resulting in a vibrating wheel that leaves chatter marks on the work and shortens the life of the quill.

When the quills were made of cast iron, the manufacturing procedure was to turn the outside for the full length and then grind this surface, after which seats for ball bearings were bored in each end of the casting. The quill was next chucked in a special collet on an internal grinder and the overhanging end supported by a steadyrest, while a portable precision grinder mounted on the carriage in place of the standard spindle was employed to grind the ball-bearing seats.

No matter how much care was taken in this op-

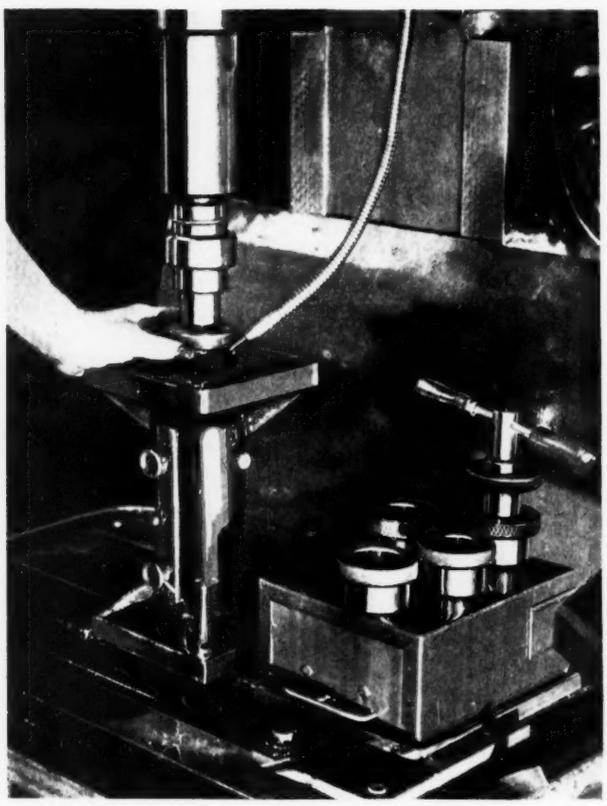


Fig. 1. The Use of a Tumble Jig Facilitates the Boring and Reaming of Ball-bearing Seats in Quill Tubes for Portable Precision Grinders, Accurately in Alignment with Each Other

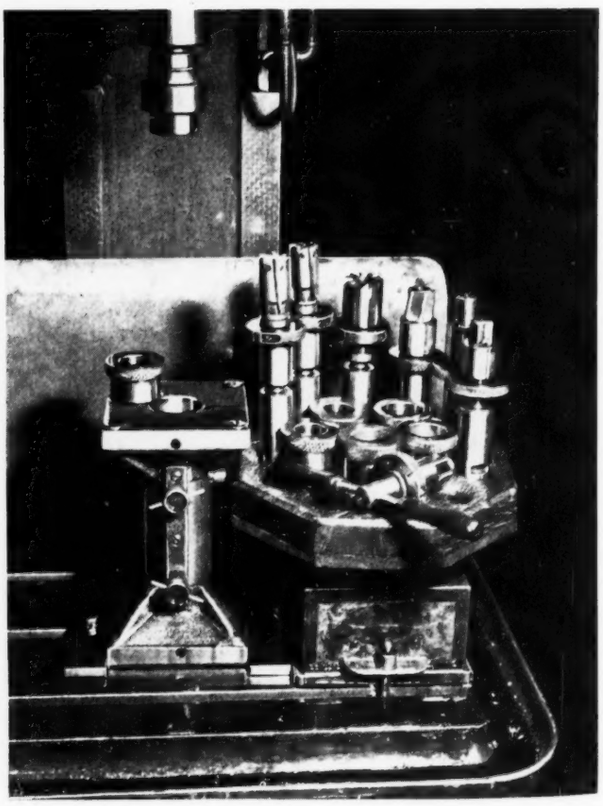


Fig. 2. The Tools Here Shown are Used for a Series of Facing, Counterboring, Reaming, and Tapping Operations Performed on Each End of the Quill Tubes Supplied on Dumore Grinders

eration, some misalignment usually existed between the two bearing seats, due to the fact that any eccentricity of the outside of the tube was transmitted to the inside by the steadyrest. However, the principal reason for misalignment was the independent grinding of each bearing seat. Either seat could be accurate as far as its own dimensions were concerned and still be out of line with the other seat.

The cast-iron quills had other faults that were inherent in the material. For instance, in high-speed applications, the heat generated caused the cast iron to expand lengthwise more than the wheel-spindle, because of the difference in the coefficients of expansion of iron and steel. This placed a strain on the ball bearings and made it impossible to lock them satisfactorily. Also, the cast-iron quills had a natural tendency to warp, which necessitated a great deal of lapping and hand fitting in the final assembly. This slowed up production and resulted in high manufacturing costs.

These manufacturing and service difficulties led to the adoption of cold-rolled steel for the quills. It was known beforehand that the steel tubes would be stronger than cast-iron tubes and that there would be equal expansion of a tube and its spindle as they became heated. However, considerable research was necessary before the problem of machining the two bearing seats in precise alignment was solved.

The steel quills are tubes ranging in length from 8 1/2 to 9 1/2 inches and in outside diameter from 1 3/4 to 2 inches. Specified lengths must be maintained within plus 0.000, minus 0.001 inch, and the outside diameter within the same limits. The first operation in the production of the steel quills is performed in a hand screw machine and consists of drilling the cold-rolled bar stock, end to end, and cutting off to length. Then a seat for a ball bearing is rough-counterbored in each end of the tube and the counterbored holes are beveled for centering purposes in the next operation, which consists of rough-grinding the outside diameter. Two small holes are next drilled and tapped through the tube wall, after which the outside diameter is finish-ground.

The final operations on the tube, upon which its accuracy largely depends, are performed on a drilling machine, with the tube held in a box jig, as shown in Fig. 1. This jig can be turned end for end to finish the bearing seats in the two ends of the tube closely in line with each other. The jig has a ground hole extending its full length, and the work fits this hole closely. It is located lengthwise by entering a dowel-pin into one of the holes previously drilled through the tube wall and is clamped by means of two knobs on the fixture. Slip guide bushings are placed in the upper end of the jig prior to taking the various cuts, for piloting the tools. With this arrangement, the bearing seats are produced in true alignment with each other, even though the tube is not held perfectly straight.

Six different tools are used on each end of the tube in this operation. The first tool, which is an end-mill, faces the quill end for length. Then a five-lip cutter semi-finish-bores the ball-bearing seat to the bottom. The third tool faces the shoulder of the bearing seat, and the fourth tool bores the tube in front of the bearing seat to a thread diameter. The fifth tool rough-reams the bearing seat and the sixth tool semi-finish-reams the same surface to size within plus 0.00025 inch, minus 0.0000 inch. These various tools are seen in Fig. 2, as well as a hand tap used at the end of the operation for cutting threads in front of the bearing seat to receive a threaded collar that holds the bearing in place. When all these cuts have been taken on one end of the tube, the box jig is simply turned over and similar cuts taken on the opposite end.

Although coolant is generously supplied in taking these cuts, some expansion of the steel occurs, and therefore, after the tube is taken from the jig, it is allowed to cool preparatory to a final finish-reaming operation on the bearing seats. This operation is performed in a lathe, the bearing seats being reamed within limits of plus 0.0001 inch, minus 0.0000 inch, which provides a snug, but not a pinched, bearing fit.

With this changed manufacturing method, production schedules can be readily maintained and the assembly of the quill units has been facilitated. Time is no longer required for hand lapping of bearing seats or for changing ball bearings to compensate for inaccuracies of bearing seat alignment, as with cast-iron quills. In addition, the steel quills have from 25 to 35 per cent more potential life.

* * *

What it Costs Industry to "Give a Man a Job"

In a booklet entitled "What is a Job?" published by the General Motors Corporation, it is mentioned that for every employe with General Motors an investment of more than $6000 in factory buildings, tools, equipment, and materials is required. Furthermore, for every five men employed in factory production, one worker must be employed in research, engineering, purchasing, selling, advertising, or clerical work.

"Jobs are not created over night by the wave of someone's hand," says the booklet. "A job does not consist only of a man that works. Back of the man at work there must be a factory and machines. There must be supervision and management, engineers, research workers, and inspectors. There must be trained men to say what to produce, how to produce it, and when to produce it."

We ordinarily think of capital as money, but capital is not just money. We simply use dollars to measure the value of capital, just as we use scales to weigh sugar. The capital of a manufacturing corporation consists mainly of buildings, machinery and materials. These buildings, machinery and materials were paid for by the savings of a great many people, generally grouped together as investors.

Practice in Machining Zinc-Alloy Die-Castings

Directions for Machining Die-Castings, Compiled by the New Jersey Zinc Co. on the Basis of Information Obtained from a Great Number of Plants where Die-Castings are Produced and Machined, and from Makers of the Required Tools and Equipment — Last of Six Articles

THE five preceding articles in this series have dealt with the machining operations ordinarily required in finishing die-castings. The present article will deal with a number of miscellaneous operations, such as sawing, spinning, swaging, riveting, punching, filing, burring, bending, and knurling. Welding and soldering can also be done under certain conditions, but are not included here, as they are not machining operations in the ordinary sense.

Sawing is often performed in removing the sprue or gate from die-castings, but is a rather infrequent operation on the casting itself, though very easily accomplished when required. Band, circular, or jig saws can be employed. They should have enough tooth-set to clear the saw. For most sawing, about 7 to 10 teeth per inch are recommended, but for sawing thin sections, the number of teeth may have to be increased. The tooth speed of circular or band saws should be approximately 2000 to 3000 feet per minute. Circular saws of about 18 gage, 10 inches in diameter, have been used successfully. Band saws of the soft back type, 0.032 inch thick, and set to cut a slot about 1/16 inch wide, give good results. They should have about 8 teeth per inch and a tooth speed of about 2500 feet per minute. Jig saws having 8 teeth per inch and making about 250 to 300 strokes a minute are recommended by one manufacturer. Flexible-back 6-inch blades, 5/16 inch wide and 0.040 inch thick, are used, as well as blades of high-speed steel of the same specifications.

Spinning operations are quite often performed in fastening die-castings together or to parts of other metals, either at a thin lip provided for the purpose, or on the end of a projecting part where it passes through a mating part. As the metal is quite ductile, ordinary spinning tools can be employed. The work can be done rapidly. One engineer states that Carboloy spinning tools more than repay the extra cost involved.

Swaging is also readily done cold. It results in improved tensile strength of the part swaged, up to a reduction in area of 40 per cent. It does not make the standard zinc die-casting alloys sensitive to intergranular attack.

Riveting of die-castings (either riveting two castings together or one casting to a mating part of another metal) is a common operation. Rivets are often made as an integral part of the die-casting, and since the metal is quite ductile at ordinary temperatures, the rivets are readily headed over. The ductility reaches a maximum at a temperature of about 212 degrees F.; hence the casting may be heated in boiling water if the greatest ductility is desired. Riveting can be done on castings at a temperature of 70 degrees F., but should not be done, as a rule, at lower temperatures, as the ductility of zinc alloys decreases rapidly below this temperature.

Punching of small holes and similar shearing operations can be done on thin walls of castings when they are properly supported by a lower die, and occasionally holes can be punched more rapidly than drilled. Cored holes often contain a fin which is conveniently "cleared" by a punching operation; external fins are cleared by forcing the casting through a shaving die.

When fins are to be punched from cored holes, it is sometimes an advantage to use a sufficient taper in the hole to permit of using the hole itself as the die. By punching the fin toward the large end of the hole, objectionable burrs can often be eliminated. The included angle of the taper in these cases ranges from 3 to 20 degrees, depending on the conditions.

For removing light fins, small hand presses or special tools operated by a rack and pinion are often used to advantage; kick presses are also used; and for large castings, power presses are employed extensively. In all cases, the time required per piece is chiefly that needed to insert and remove the piece, the stroke of the press being almost instantaneous. In general, it is best to have the temperature of the casting at 70 degrees F. or above, because of the rapid decrease in impact strength below that temperature.

Filing and *burring*, especially the former, are very frequent operations. Filing is nearly always done by hand, and usually consists chiefly in removing burrs or light fins that cannot be removed so conveniently or economically in machine opera-

tions. Some shops do almost no hand filing, and there is a tendency to avoid it by good design and effective use of well made cleaning tools. For short-run jobs, or where burrs or fins are not readily removed by other means, filing is used; any file suitable for rapid work on soft metal can be employed. Burrs or rotary files of standard types are sometimes used to advantage, as in cleaning fins at the junction of intersecting cored holes, where other cleaning tools could not be employed readily.

Bending of projecting parts of zinc-alloy die-castings which cannot be conveniently cast in curved form can be accomplished after casting, within certain limits, provided the casting is first heated to about 212 degrees F. The heating can be done in boiling water, or in a muffle or oven, as desired. It is sometimes possible to make pairs of fittings, rights and lefts, by using single-cavity dies and bending some part of the casting appropriately. If the run is to be quite long, however, and it is feasible to cast the piece initially to the desired shape, it may prove more economical to make two cavities to yield right- and left-hand parts, thereby making bending unnecessary.

Planing and *shaping* can be done on die-cast zinc, but in general, the same work can be done more rapidly on other machines; hence planers and shapers are rarely if ever used.

Gear-cutting operations are entirely feasible on die-cast blanks, but since it is possible to cast gears of many types having the teeth ready formed within quite close dimensions, these teeth are seldom machined. With spur gears, a slight draft on the face of the teeth is needed to clear the die if the gear has a wide face; and if a straight tooth face without draft is required, it can be machined or produced by using a properly formed shaving die. It is possible to die-cast internal gears and stepped gear clusters that cannot be produced economically by machining or that can be made otherwise only by using a built-up assembly.

Knurling, though feasible, is seldom required on die-castings, because it is usually a simple matter to die-cast knurled surfaces or to use flutes or some substitute for knurling that serves the same purpose and can be made in the casting process.

* * *

New United States Customs Regulations

The "Custom House Guide" for 1938 has just been published. It contains as one of its principal features the new United States Customs Regulations for 1937, which entirely supersede the old 1931 regulations. It is the only copy of these regulations, revised with amendments to date, available in print. It also includes the new rates of duty established under the sixteen reciprocal trade agreements made by the United States with foreign nations, as well as the revisions enacted by Congress. The cost of the guide is $15. It can be obtained by addressing Custom House Guide, Box 7, Station P, Custom House, New York.

Talking Pictures for Foremen's Conferences

A series of talking still pictures that dramatize plant and personnel problems and indicate proved methods of solving them has been brought out by MacVeagh & Co., Inc., 630 Fifth Ave., New York City, as a service available to manufacturing plants. These pictures have demonstrated their practical value in several industries that are already using them, in which relations between management and workers are said to have been noticeably improved.

The service was developed in answer to the requirements of certain industrial organizations that realized that one of the important jobs facing industry today is the promotion of better human relations and mutual understanding between management and labor. The problem of labor relations is attacked through the foreman.

It has been shown in many plants that the most likely cause of friction and misunderstanding between the management and the workers is the foremen's methods of handling the human side of their job. These pictures are intended to arouse the foremen's interest in important problems, to the solution of which they can greatly contribute. Among the subjects dealt with are safety, teamwork, leadership, waste, mutual understanding, developing understudies, grievances and how to handle them, quality and costs, suggestions and ideas, errors, and system and order in the plant.

* * *

Gear Manufacturers to Meet at Niagara Falls

The dates for the twenty-second annual meeting of the American Gear Manufacturers Association, to be held at the General Brock Hotel, Niagara Falls, Canada, have been changed to April 25 to 27. Previously, it was intended to hold the meeting a week earlier. A large number of papers have been scheduled for presentation at the meeting. The subjects to be dealt with include chain and sprocket drives, tooth forms, gear noise, non-metallic materials for gears, welding in gear manufacture, lubrication of gearing, ball-bearing design for heavy-duty applications, rates of depreciation, and practical problems in handling men.

* * *

It is estimated that within a span of thirty years the annual tire bill of the average automobile owner has dropped from about $220 to $15. In 1907, a car driven moderately, as was the custom in those days, would require not less than five new tires a year. At that time, a tire and tube, good for only about 3000 miles, cost about $44. In 1937, for the same amount of use, the tire cost would not exceed $15. This is what research, development, and improved machinery have done.

A Definite Plan for Fair Labor Legislation

THE editorial in January MACHINERY, page 306, "Industrial Leaders Must Aid in Guiding Public Policies" suggests that industry must take an active part in proposing specific measures relating to labor and tax legislation. So far, industry has submitted to whatever legislation has been passed. There have been protests here and there, but they have been ineffective because business and industry as a whole have not stood together in voicing these protests when unfair legislation was proposed or passed.

The writer, who has been connected with industry in various capacities and has worked both at the bench and at the machine, believes that the following additions to the Wagner Labor Act ought to be proposed as reasonable and acceptable to fair-minded men, whether employers or employes. These suggestions are not original with the writer; they have been proposed in somewhat similar form by several manufacturing executives.

Labor unions should be incorporated, in order to establish their legal and financial responsibility for carrying out their part of any agreement, the same as any manufacturing concern. If the employer is legally responsible for his part of an agreement, it is only fair that the labor organization should be equally responsible.

It should be illegal to call strikes without the consent of a majority of the workers in a plant, as duly ascertained by a properly supervised vote. This will avoid coercion and intimidation from either employer, labor organizer, or fellow employes.

Picketing in any strike should be restricted to employes of the particular plant being picketed. It should be unlawful to block streets and entrances to plants and offices by pickets. It should be unlawful to picket, or to state that a strike exists in, a plant in which 50 per cent or more of the normal number of regular employes are at work.

Sit-down strikes should be declared unlawful.

Restitution should be required of a striking union for all destruction or damage to property, and the union should be liable to appropriate penalties and indemnities when personal injuries are inflicted on non-striking employes by pickets or strikers.

Both the employer and a certain percentage of the employes should have the right to request an election. Under the present law, only the employes have that right. There is no reason to discriminate against the employer in this respect. He is only asking for an expression of opinion of his employes by a duly supervised vote.

Coercion and intimidation at any time, anywhere, by anyone, should be unlawful and carry appropriate penalties; this should apply to employer, labor organizer, and employes alike.

Management should have the right to express its views on labor unions and the actions of union officials just as freely as, under the present law, union officials and employes have the right to express their opinions about employers. The present Wagner Act throttles the traditional American right of free speech as far as management is concerned.

The law should distinctly provide that a labor election does not impose unionization, or any particular union, upon the plant and its employes *for all time to come.* The opinions of employes with regard to their union affiliation should be ascertained by a vote at regular intervals.

When there is a breach of contract on the part of a union or its members, the right of its officers or representatives to negotiate for the union should be automatically suspended until satisfactory amends for the breach of contract have been made.

Union officials should not be permitted to make assessments on union members for political purposes. The British Trades Disputes Act definitely gives union members the power to forbid their officers to use their dues for political purposes.

The law should provide that officers and agents of unions be American citizens.

The law should definitely recognize the principle that the right to work without molestation is as inherent as the right to belong to a union or the right to strike.

Just as it should be made unlawful for employers to store arms or other defensive means to be used for strike purposes, so it should be made unlawful for pickets to have firearms, clubs, or any other weapons which may be used to cause injury.

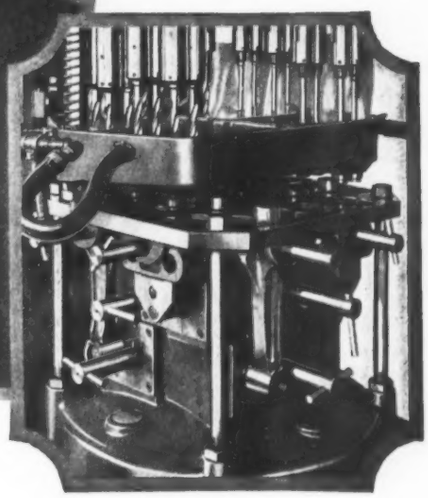
Labor organizations should be required to submit reports periodically to the Government covering their financial operations, including membership dues, salaries of officers, contributions to political campaign funds, if any, and all other expenditures. Employers are required by law to disclose to the Government their financial status and operations. There is no reason why the same regulations should not be required of labor unions. O. G.

* * *

Western Metal Exposition in Los Angeles

The Western Metal Exposition and Congress, to be held in the Pan-Pacific Auditorium, Los Angeles, Calif., March 21 to 25, under the auspices of the American Society for Metals, will have over one hundred exhibitors from every part of the United States. Eighteen national technical societies will cooperate in the Congress. Special sessions will be devoted to machineability, foundry, petroleum, aeronautics, mining and chemistry, and welding. The spring meeting of the American Society of Mechanical Engineers will be held in the Biltmore Hotel, Los Angeles, during the same week as the Western Metal Congress. The mechanical engineers will have sessions on machine shop practice, aeronautics, hydraulics, and petroleum.

Design of Tools and Fixtures

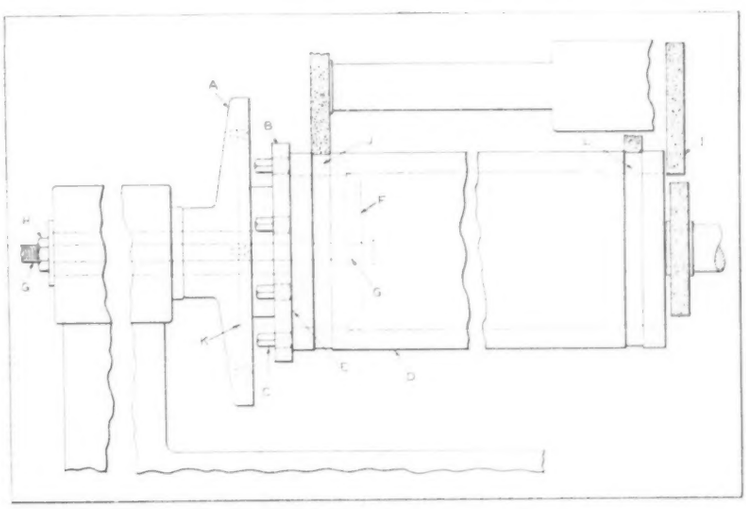


Grinding Concentric Bores at Ends of Long Sleeves

By LIONEL BOUDREAU, Putnam, Conn.

The accurate grinding of bores at the ends of long recessed sleeves or bushings, such as shown at *D* in the accompanying illustration, is accomplished by whatever means are available if only one or two sleeves are to be ground. However, when there is a considerable quantity of such work, a jig or fixture must be devised that will enable the grinding operation to be performed accurately and economically.

The sleeve shown in the illustration is 13 inches long, has an outside diameter of 4 1/2 inches, and a 3 1/2-inch bore. The bearings on each end of the bore are 1 1/4 inches wide, and the recess is 1/16 inch deep. The set-up devised for grinding the bores in fifty of these sleeves consists of a small-diameter faceplate *A*, threaded to fit the headstock spindle of a universal or internal grinder. The faceplate is counterbored to fit the flange *K* of the plate *B*, which is made to suit the diameter of the work. Plate *B* is held to the faceplate by four screws, and is provided with eight aligning or throw screws *C* which are adjusted to correct any lateral error at the forward end of the sleeve *D*.



Set-up for Grinding Bores at Opposite Ends of Long Sleeve

The work *D* is placed against surface *E* and held there by means of the internal strap *F* and rod *G*, which extends through the spindle. Nut *H* on rod *G* is tightened just enough to hold the work while it is being trued. The end of the work in contact with plate *B* is first trued as nearly concentric with the lathe spindle as possible. This does not, however, true up the opposite end, for which the throw screws *C* are next employed. A very slight movement of one or two of the screws *C* in line with the high position shown by a dial indicator, will quickly bring the forward end of the work into alignment with the spindle.

When the work to be ground has been hardened and is more or less distorted, the truing operation becomes more complicated and requires more time. Having trued up the sleeve as described, the nut *H* is securely tightened, after which the front bearing is ground to size. It is then advisable to grind the end of the sleeve square with the hole, using the side of the grinding wheel, as shown at *I*.

The next step is to spot-grind the external concentric surfaces *J* and *L*. These concentric surfaces need not be the same diameter, and only enough material is removed to insure having concentric surfaces. The latter grinding operation serves to insure the alignment of both bearings, and is done with the internal grinding attachment, using a

larger wheel than that ordinarily employed for internal grinding, if necessary.

The position of the work on the plate *B* is next reversed and the previously outlined truing operation repeated, making sure that the ends of the throw screws *C* do not project through the surface *E* before strapping the work in place. However, the truing is now done from the surfaces *J* and *L*, which must be accurately aligned with the machine spindle; thus both ends of the sleeve are brought into accurate alignment.

The same set-up has been used successfully for grinding operations on sprockets having recessed bores, and also on long worms that must be accurately aligned with their worm-wheels. When the work to be ground has considerable overhang, it is necessary that the headstock spindle of the grinding machine be in first-class condition and that the proper feeds and speeds be employed in grinding.

Fig. 1. Cocktail-shaker Cover with Formed Spout A

Dies for Drawing and Trimming Odd-Shaped Shell

By M. J. GOLDSTEIN, New York City

Cocktail-shaker spouts of the shape shown at *A*, Fig. 1, are made from flat copper stock by blanking, drawing, and trimming the body of the spout to the shape shown at *F*, Fig. 2. A brass part produced on a screw machine is soldered to the outer end of the spout. This brass part, shown at *H*, Fig. 1, is threaded to fit the brass closing cap *J*, which is also a screw machine product. The spout thus fabricated is soldered to the top of the shaker, as indicated in Fig. 1.

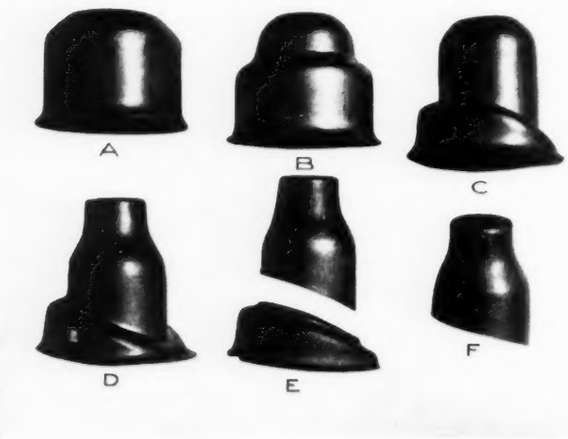


Fig. 2. Six Steps in the Production of the Cocktail-shaker Spout

There is nothing unusual about the screw machine operations on the brass parts, but the production of the shell or body of the spout involves the use of dies of more than passing interest. The six dies used in producing the spout body *F*, Fig. 2, are shown in Figs. 3 to 8. The shape to which each die forms or trims the shell is shown by views *A* to *F*, Fig. 2.

The first operation is performed on an ordinary combination blanking and drawing die of the design shown in Fig. 3. The spouts are drawn from 22-gage (0.025 inch thick) deep-drawing copper, obtained in coils 3 1/4 inches wide. The shell *A*, Fig. 2, produced by this die is 1 5/8 inches in diameter and 1 1/4 inches deep. The diameter of this shell is exactly one-half the blank diameter or width of the stock. This operation requires a punch having a 1/4-inch radius on the drawing edge.

The second operation is simply a preliminary one, and is performed on the die shown in Fig. 4. Part of this die is also used for the third operation. In the second operation, the shell is drawn to a reduced diameter for a length of 1/2 inch, as shown at *B*, Fig. 2. With the die in place, the pressure ring and punch are replaced by the ring and punch shown in Fig. 5 for the next operation. The pressure pins used in this operation are made a tight fit in the pressure ring, so that the ring will be held in a fixed position relative to the punch. Of course, care is exercised in setting the punch in relation to the ring.

In the third operation, the shell is drawn to a depth of 1 1/2 inches and to the shape shown at *C*, Fig. 2. Each die used in the preceding operations is equipped with a rubber pressure pad or barrel having a diameter of 4 inches and a length of 7 inches. However, very little pressure is required for the second and third operations.

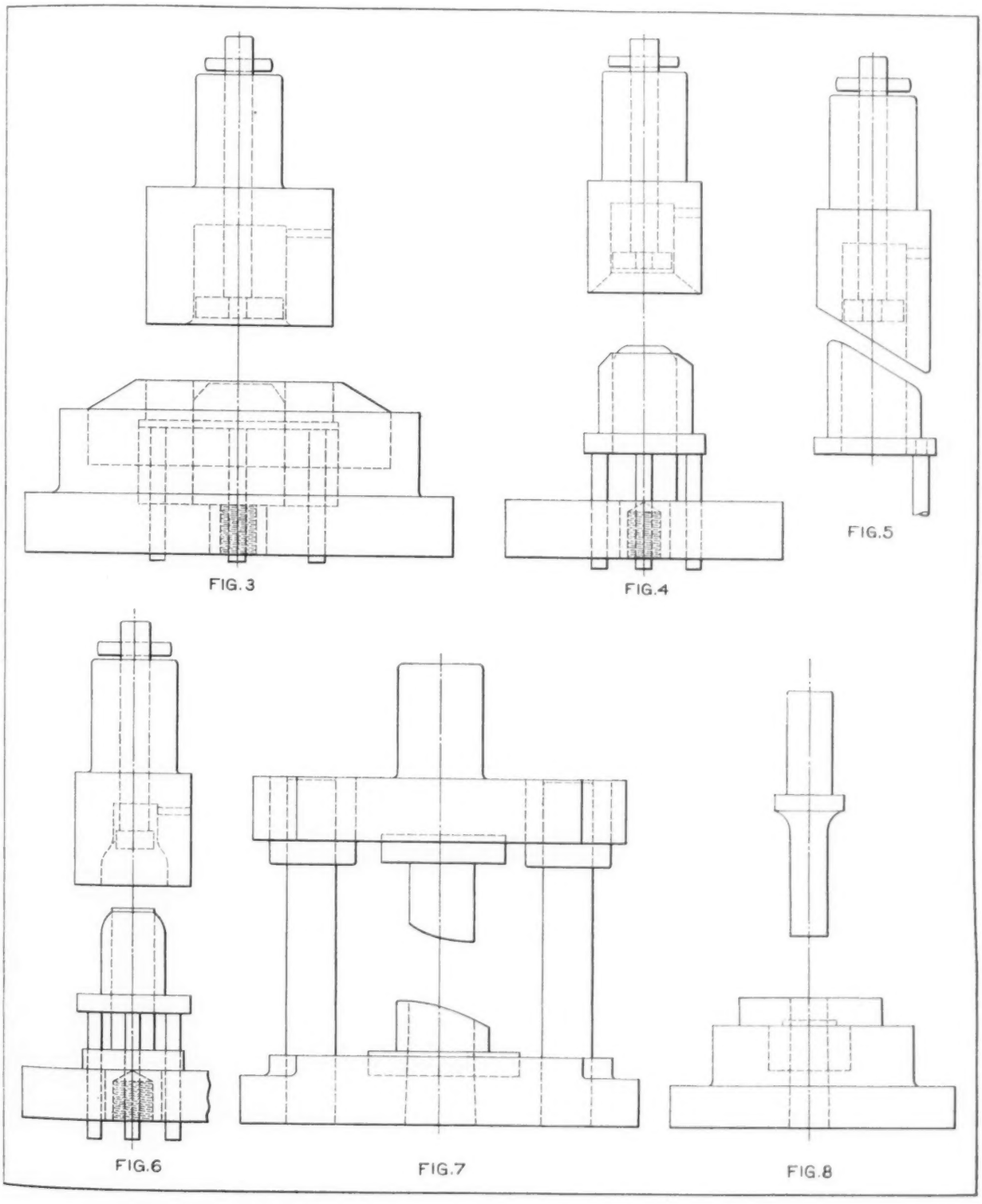
At first glance, the third operation may appear impractical, and, in fact, it did not work with any real satisfaction until the preliminary operation was adopted, after which satisfactory results were obtained. It is advantageous to clamp the die very firmly in place to prevent any movement which might cause slight irregularities in the surface of the shell at the point where the third operation continues the forming work.

The fourth operation combines the reduction of the neck of the shell and the finish-forming to the final shape. This work was done on the die shown in Fig. 6. While it is unusual to combine operations in this way, the method worked satisfactorily and eliminated an operation. The finish-formed shell is shown at *D*, Fig. 2.

In the fifth operation, the flange is trimmed off the shell, as shown at *E*. It might appear at first that this operation would give trouble on account of the form that must be given the edges of the

shell in order to have it fit the spherical portion of the shaker top, as indicated in Fig. 1. Great care in planning the shape of the cutting edges and in the general design of the die seen in Fig. 7, which is used for this operation, gave the results desired.

Rigidity is insured by using a pillar die shoe. In blanking or trimming operations, the shape of the blank or piece trimmed tends to follow that of the punch. The punch, therefore, is formed at the cutting edge to the shape required, which, in this case, is approximately a spherical form having a 4-inch diameter. While the large diameter of the shell is cylindrical, the die opening is made oval, due to

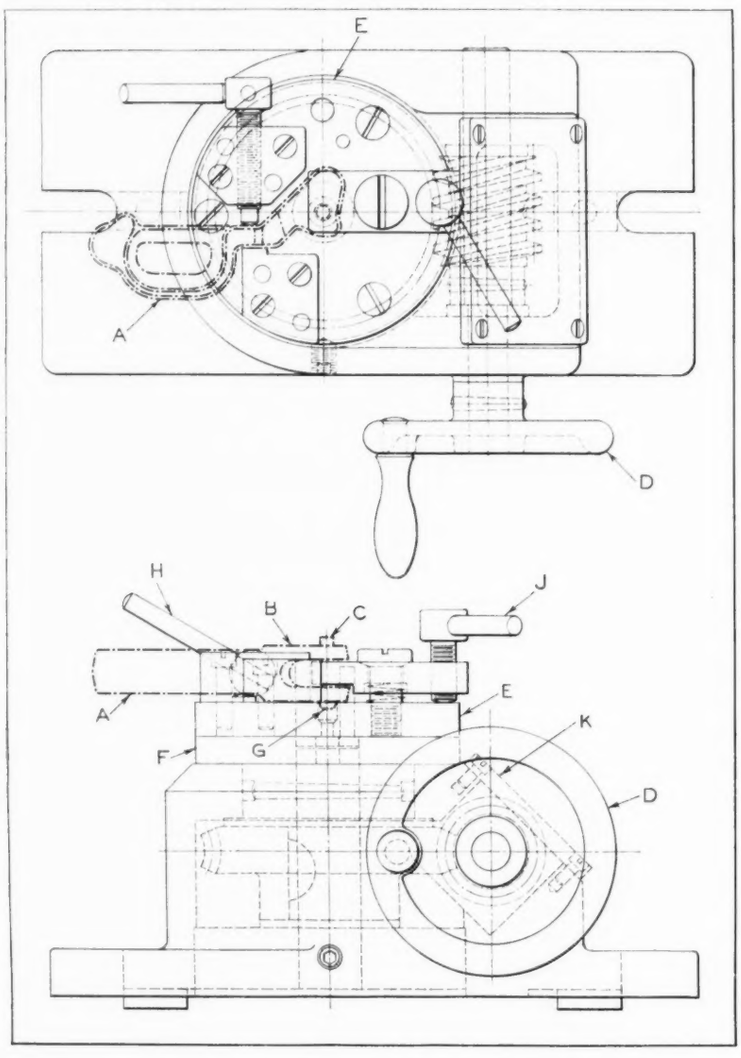


Figs. 3 to 8. Outline Views of Dies and Punches Employed for the Six Press Operations Required in Forming a Spout in the Manner Illustrated in Fig. 2

the angularity of the cutting surface of the die. The edge of the shell is cut cleanly and requires no fitting preparatory to soldering.

The final operation is performed in a foot-operated press equipped with the die shown in Fig. 8. This is a simple, perforating die having a diameter of 11/16 inch, with a nest designed to locate the shell properly. After this operation, the shells are ready to have the threaded brass part soldered to the end.

Great care is exercised in maintaining the proper drawing edges on the punches. This applies especially to the third-operation die, Fig. 5. In this operation, the metal on the long side of the shell moves at an angle of 45 degrees in relation to the direction of the draw, whereas on the opposite side, the metal has to move at an angle of 90 degrees to the side of the shell. For this drawing operation, only the minimum clearance should be allowed between the punch and die; otherwise, wrinkles will develop on the long side of the shell. A set of dies made as described has already turned out about 75,000 pieces.



Fixture for Finishing Surface B and Cylindrical Surface of Trunnion C

Rotary Milling Fixture

By F. SERVER

The fixture here illustrated is used on a vertical-spindle milling machine for finishing the surface *B* and the cylindrical surface of the trunnion *C* on the work shown by the dot-and-dash lines at *A*. Turning the handwheel *D* revolves the work about trunnion *C* as a center while an end milling cutter held in the machine spindle and set off center a distance equal to the radius of the trunnion mills the entire surface *B* and finishes the trunnion *C* to the required diameter.

A worm on the handwheel shaft rotates a worm-wheel keyed to the vertical shaft on which the work-holding disk *E* is mounted. Disk *E* is fastened to a disk *F*, keyed to the vertical shaft, and can be removed and replaced by other disks equipped with clamps designed to hold work of different shapes or sizes. The work *A* is located by the rough boss or trunnion *G* which fits into a hole in a locating block attached to plate *E*.

The illustration shows clearly the shape of the locating blocks and the arrangement of the clamps operated by handles *H* and *J*. The opening in the base in which the worm is assembled is closed by the plate *K*. The base of the fixture shown is of cast design, but a fixture of the same form has been constructed of all-welded steel, which in appearance, closely resembles the cast-iron base.

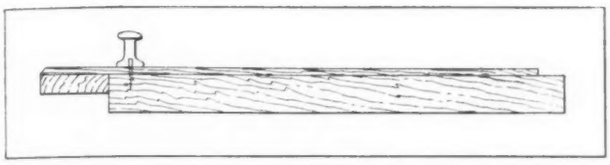
* * *

Foundry Convention to be Held in Cleveland

The forty-second annual convention of the American Foundrymen's Association will be held in Cleveland, Ohio, May 16 to 19. A foundry exhibition will be held in conjunction with the convention which will open on May 14 and continue throughout the convention. The meetings and exhibition will be held in the Cleveland Public Auditorium. The program lists thirty-five sessions, covering almost every conceivable topic connected with the steel, malleable, non-ferrous, and gray-iron foundry industries. At the management sessions, apprentice and foremen training, safety, melting costs, job evaluation, and time study will be discussed. Three shop operation courses are being organized on malleable founding, cast-iron founding, and sand control. An apprentice prize contest is also included. Further information may be obtained from the American Foundrymen's Association, 222 W. Adams St., Chicago, Ill.

Ideas for the Shop and Drafting-Room

Time- and Labor-Saving Devices and Methods that Have been Found Useful by Men Engaged in Machine Design and Shop Work



Method of Holding T-square on Drawing-board

Kink for Holding T-Square on Drawing-Board

In using a small drawing-board and T-square, the writer often employs the time-saving kink shown in the accompanying diagram. It consists simply of fastening the T-square to the drawing-board with a thumb-tack or push-pin, as indicated. This leaves the hands free to manipulate set-squares, protractors, etc.

A hole is drilled through the blade of the T-square through which the push-pin is inserted, care being taken to have it located on the side of the hole farthest from the guiding edge of the drawing-board and also at a slight angle, so that the head of the T-square is drawn tightly against the board. F. H.

Holding Tapered Work in a Vise

A production job requiring the holding of tapered pieces in a vise sometimes proves troublesome. In handling such work, sections of old flat mill files can be used to advantage, as described in the following: Suppose, for example, that it is necessary to hold a piece of work having one side machined at an angle of 10 degrees with the opposite side. If a 10-degree wedge is made and combined with the work-piece so that the taper is reversed, a parallel assembly will result which can be held in the vise, provided it can be kept from slipping.

If the taper is steep, however, the work will be likely to slip. To prevent slipping, one or more of the file sections should be tack-welded to the tapered edge of the wedge, with the file teeth pointing in the proper direction to resist sliding. The teeth on the file sections will dig in slightly if the work begins to slide and thus hold the material securely in place.

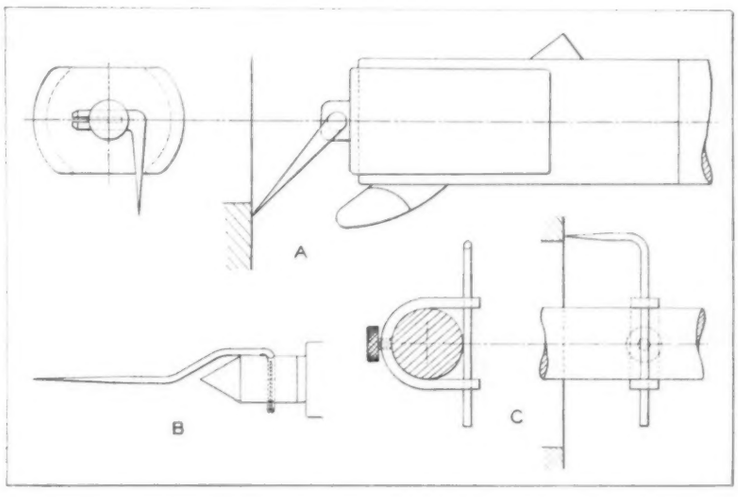
This kink is, of course, applicable to either bench or machine vises. Wherever a non-slipping surface is desired, it is well to consider welding on a worn-out file section. There are vises that are so made that one of the jaws can be swung in an arc for holding tapered work. Such vises are, of course, superior to the method outlined; but where a tapered vise is not available, the use of old files as outlined will prove advantageous.

Peoria, Ill. JOHN E. HYLER

Test-Needle Fittings for Lathe Work

The three testing needles shown at *A*, *B*, and *C* in the illustration can be quickly applied to lathe work for testing the squareness of a machined face with the lathe spindle or the concentricity of a bored hole. The springiness of the slotted sleeve of the tester shown at *A* permits it to be slipped over a boring tool holder. The needle is held in any desired position by the split shank, which is sprung into the hole in the lug.

The means for holding the tester shown at *B* consists simply of a hole drilled in the back center, into which the split shank of the needle is inserted. The clip device shown at *C* can be placed on a boring-bar mounted between the lathe centers or on the boring-bar of a boring machine. It can be applied or removed in a few moments by simply loosening the knurled head-screw. The needle can be adjusted to any desired position. F. H.



Test-needle Fittings for Use in Squaring up and Testing Lathe Work

Questions and Answers

A Department in which the Readers of MACHINERY are Given an Opportunity to Exchange Information on Questions Pertaining to the Machine Industries

Turning Over the Edges of Brass Shells

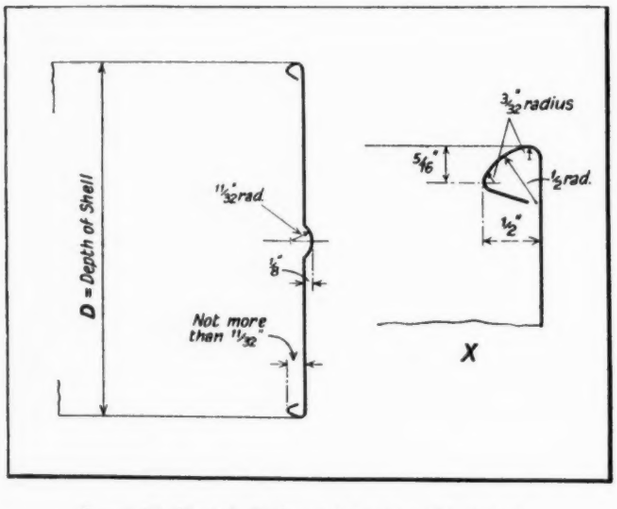
G. B.—We are producing cylindrical shells, open at both ends, from 20-gage rolled-brass sheets. The sheets are bent to the cylindrical shape and the edges are silver-soldered. The standard shells measure 14 inches in diameter, and the depth *D* as indicated in the accompanying illustration varies from 5 to 6 1/2 inches. It is required to turn the edges over, the desired form being shown in the enlarged view at *X*. Attempts have been made to perform this work by spinning, but trouble is experienced through failure of the soldered joint before the spinning process can be completed. Information on the best method of overcoming this difficulty is desired.

Answered by A. Eyles

The probable causes of failure in forming the edges at both ends of the cylindrical brass shell by the spinning process are the working of the metal excessively without annealing it, the selection of an unsuitable grade of brass sheet, or the use of a silver solder that does not give a strong, ductile joint. It is always advisable to anneal brass sheet material two or three times for this type of spinning operation rather than risk fracturing the metal or the jointing material. In large establishments, muffle furnaces are generally used for annealing.

With regard to a suitable annealing temperature for the brass shells, 1100 degrees F. will adequately cover requirements. Annealing at higher temperatures results not only in wasting fuel, but also in heavy scaling losses and possible impairment of the physical properties of the metal.

The most suitable grade of brass for producing shells of the special shape required and forming the edges by spinning is 70-30, as this grade possesses the highest ductility. Regarding the temper of the brass sheet, the material that comes within the "half hard" range is to be preferred to either "soft" or "hard" temper material.



Brass Shell with Enlarged Section X of Roll Required at Each End

---

Franchise and Sales Taxes Outside of Manufacturer's Own State

A. M. M.—As a seller, am I required to pay a franchise tax or a sales tax on machinery distributed in a foreign state, if I have a salesman in such foreign state, maintain a warehouse arrangement there, but do *not* have an office in the state?

Answered by Leo T. Parker, Attorney-at-Law
Cincinnati, Ohio

You may be required to pay taxes on merchandise stored in the foreign state, but this is separate from taxation on the interstate distribution of merchandise.

The Supreme Court of the United States, in Binderup, 263 U. S. 291, decided that a manufacturer in New York who made contracts with a dealer in Nebraska was doing interstate business. The merchandise was shipped from New York to a distributor in Nebraska who delivered it to dealers in the latter state with whom the seller previously had made contracts. Although the goods were placed in a warehouse in Nebraska, the Supreme Court held the transactions to be interstate, which resulted in the seller not "doing business" in Nebraska. [For variations of the law see the following cases: 196 U. S. 375; 186 U. S. 622; 251 U. S. 95; 192 U. S. 500; 209 U. S. 211; 227 U. S. 505.]

* * *

Some of the progress that has been made by the railroads during the last twenty years may not be obvious to the casual observer. It is, therefore, of interest to note that the average tractive effort of steam locomotives has been increased 35 per cent since 1920, while the fuel consumption in freight service, per 1000 gross ton-miles, has decreased 31 per cent during the same period.

Tube Ends Reinforced to Facilitate Resistance Welding

BICYCLE frames are being manufactured by the Cleveland Welding Co., Cleveland, Ohio, on a high-production basis through the use of the Hart electric resistance welding process. This process consists essentially of reinforcing the ends of the light-gage tubing, cutting the tube ends to provide a line contact fit with the other tubes or parts to which the tube is to be welded, and the welding itself.

Reinforcing is accomplished by expanding the end of the tube slightly for a distance of 1 inch or 1 1/2 inches in the manner illustrated at *B*, Fig. 1. This is done by means of a punch. Then a reinforcing sleeve is inserted into the expanded end. In bicycle construction, the reinforcing member is generally a tube of about No. 14 gage having a heavy, coarse knurl on the outside surface, as illustrated at *A*.

After the reinforcing piece has been placed within the tube, as illustrated at *C*, the tube is pressed through a die to draw the end down over the knurled reinforcing piece to the original diameter of the tube. The points of the knurling are thus firmly embedded in the inner wall of the tube. The finished tube end appears as illustrated at *D* and in cross-section at *E*. This method of reinforcement provides a heavy wall on the ends of the tube which facilitates attaching it to other tubes or parts by the resistance welding process.

All steps involved in reinforcing the tubes—that is, expanding the tube ends, inserting the reinforcing pieces, and drawing the tube ends down to the original diameter—are accomplished in a special automatic machine. The tubes are automatically fed from a rack and the reinforcing pieces from a hopper. The successive steps in the operation are effected through the action of a hydraulic ram, an operation being performed on three different tubes at each stroke of the ram and indexing of the work-carrier.

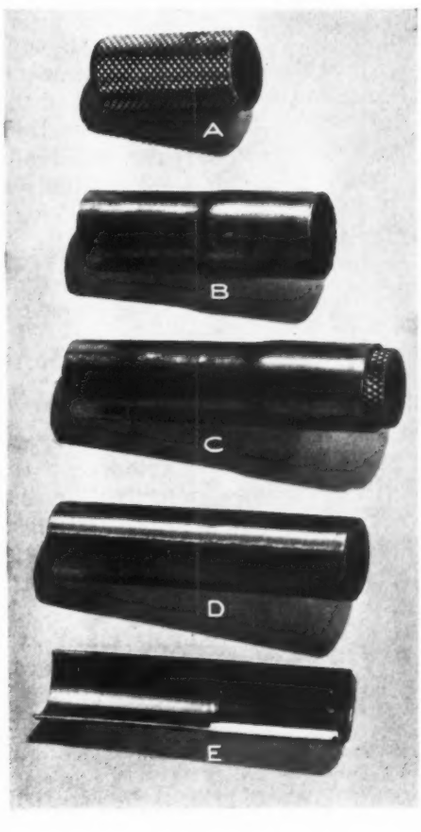


Fig. 1. Various Steps in the Reinforcing of Thin-gage Steel Tubing to Prepare it for the Welding of Bicycle Frames

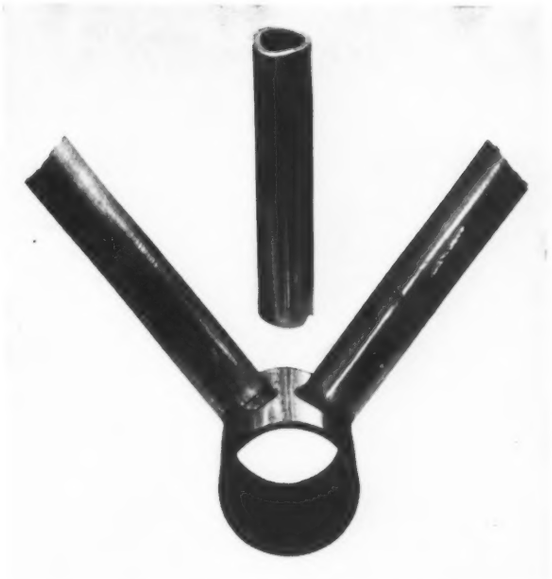


Fig. 2. Typical Welds Made by the Hart Electric Resistance Welding Process without External Flash

The second step in the Hart process is to machine the reinforced tube end in such a manner that a line contact will be made between the inner edge of the tube and the part to which it is to be welded. A small wedge-shaped space extends from this line of contact to the outer edge of the tubing. The desired contour of the ends of the reinforced tube is milled with a form cutter in a semi-automatic machine which operates on the two ends of a tube simultaneously. In the upper center of Fig. 2 may be seen a short piece of tubing that has been milled at both ends to provide line contact with the other pieces to which this tubing is to be welded.

The third step in the Hart process is to bring the machined end of the tube into contact under heavy pressure with the part to which it is to be welded and then apply a very high current for a short time. In bicycle construction, the pressure is approximately one or two tons. The instantaneous current demand during the welding ranges from 150 to 250 kilovolt amperes, and the

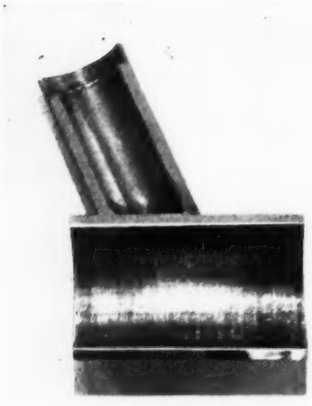


Fig. 3. Cross-section Showing Manner in which Reinforced Tubing Fuses to Part to which it is Welded

time interval is from 4 to 10 cycles, with 60-cycle current. This operation is performed automatically in special press welders, the entire cycle requiring from two to three seconds. The machines are equipped with Westinghouse Ignitron timers.

This welding process provides clean joints, without external flash, that require no finishing, as will be seen by referring to the bottom view of Fig. 2, where two such joints may be seen as they come from the welding machine. Many bending, tension, and vibration tests have shown that joints welded by this process are stronger than the tubing itself. The cross-section in Fig. 3 shows the complete fusion that occurs between the welded tubes and the reinforcing member.

The Hart process here outlined is covered by United States Patent No. 2,091,982 and other patents pending, to which exclusive rights are owned by Steel & Tubes, Inc., Cleveland, Ohio, a subsidiary of the Republic Steel Corporation. The Cleveland Welding Co. operates under a license from the concern mentioned.

* * *

Malleable Iron Industry Pushes Research

The Research and Development Committee of the Malleable Founders' Society, at a recent meeting in Cleveland, Ohio, planned its research program for the current year. The first phase of the program will cover practical research, and includes the correlation of information on the processes and equipment employed by the seventy-two member plants engaged in the manufacture of malleable iron. The immediate objective of this practical survey will be to develop reliable standards for annealing. The committee's second major activity will involve pure research, including laboratory studies. It will include, among other subjects, investigations on the prevention of shrinkage and on graphitization.

* * *

In the building of one average-sized modern locomotive, employment is provided equivalent to the work of fifty men for an entire year.

Flame-Softening

An important development in connection with oxy-acetylene cutting is the flame-softening process for counteracting the hardening effect of oxy-acetylene cutting on certain steels, such as low-carbon, high-strength, structural steels. From a fabrication standpoint, the oxy-acetylene process provides a simple and economical production tool for cutting and shaping steel. From the structural standpoint, however, the flame-cut edges must pass the required tests for the parent metal. In most cases, this means that there must be no loss in ductility and impact resistance.

The flame-softening process makes it possible to retain these qualities of the cut edges of the steel. With this procedure, multi-flame heating heads are used, either ahead of or following the cutting blowpipe. In this way, the self-quenching action of the cold base metal is reduced and the speed of the air quench is retarded, thus making it possible to cut these steels without impairing their physical properties at the surface being cut.

There are three methods of applying flame-softening. The first is applicable to plate thicknesses up to and including 1 1/2 inches, in which case a single multi-flame heating head, either directly before or after the cutting tip, is directed toward the top of the cut edge. The second treatment is applicable to thicknesses from 1 1/2 to 4 inches, and is similar to the first one, with the exception that an additional multi-flame head is directed at the bottom of the cut edge. The third method is applicable to thicknesses above 4 inches, the multi-flame head being directed against the face of the cut edge following the cutting operation, but before the steel is cooled to room temperature.

The flame-softening process has been successfully applied to cut edges of gusset plates and web plates for buildings and bridges, to structural plates, railroad cars, the cutting of high-strength steel products in steel warehouses, and the finish-treating of carbon steels of 0.40 per cent or more in steel mills.

* * *

General Electric Traveling Switchgear Exhibit

The General Electric switchgear exhibit, which started on a tour around the country May 1, last year, with a display at the Ambassador Hotel, New York City, has since been shown to 13,000 people in seventy cities in the eastern, midwestern, and southern states. Since much switchgear equipment is too large to be readily moved, many units of the exhibit are exact-scale models, designed to show simply and accurately just what the actual equipment will do. For instance, the largest oil circuit-breaker ever built was installed on the 287,000-volt Boulder Dam-Los Angeles line. This actually extends a considerable distance into the air, but it is represented by a model only 2 feet high.

Die Design and Construction

A Treatise on the Principles Embodied in the Design of Different Types of Sheet-Metal Blanking, Forming, and Drawing Dies—Second of a Series of Articles

By CHARLES R. CORY*

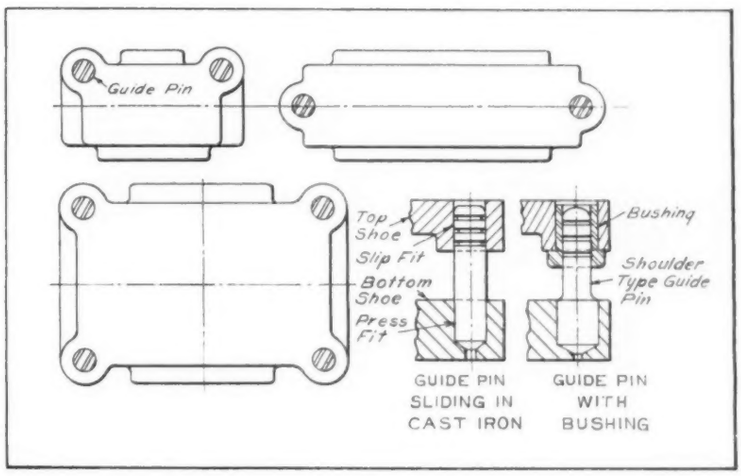


Fig. 7. Diagrammatic Illustration Showing Location and Design of Guide Pins

THE first installment of this series of articles, published in February MACHINERY, page 386, dealt with the general principles underlying the design of drop-through blanking dies, covering the construction of the die- and punch-shoes and of the punch and die itself. It referred to the calculation of the pressure for blanking, and dealt with the design of the stripper and punch adapter. The present article will consider guide pins, stop-collars, stock supports, and gages.

Arrangement and Design of Guide Pins

The guide pins, which insure correct alignment of the punch- and die-shoes, vary in number according to the size of the die. Two guide pins are used on small dies. On medium-sized dies also, two guide pins are sufficient, provided the die is narrow in the front to back direction of the press. Four guide pins are used for wide medium-sized dies and for all large dies. The guide pins are usually located as indicated in Fig. 7.

The guide pins are a press fit in the die-shoe and a slip fit in the punch-shoe. Grooves are usually cut around the part of the pin that slides in the punch-shoe, for holding and distributing oil.

The guide pins may be cold-rolled steel, untreated; cold-rolled steel, cyanided; machine steel, carburized and hardened; or hardened tool steel. Sometimes hardened steel bushings in which the guide pins slide are pressed into the punch-shoe. Unless a very high production is expected of the die or there is a great amount of lateral thrust on the guide pins, hardened steel pins running in the cast iron of the punch-shoe are satisfactory. If the guide pins are to slide in a cast-steel or soft steel punch-shoe, they must be hardened to avoid scoring.

If scrap stock rather than new strip stock is used for making the blank, the guide pins should be located at the back of the die, so that they will not interfere with the scrap stock, which may have an irregular shape. In cases where it is not known whether scrap will be used or not, it is safest to locate the guide pins at the back of the die, so that scrap may be used, if desired.

*Die Engineer, Fisher Body Division, General Motors Corporation, Detroit, Mich.

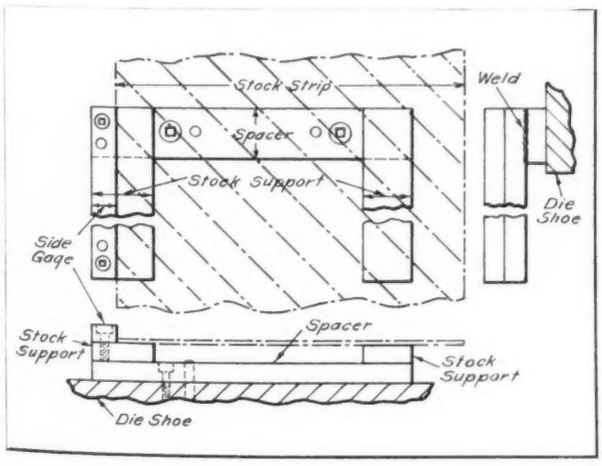


Fig. 8. Arrangement of Stock Supports and Side Gage

The Application of Stop-Collars

Either stop-collars are provided around the guide pins (see Fig. 1, page 386, February MACHINERY) or stop-blocks are mounted on the guide pin bosses to act as spacers between the punch- and die-shoes when the die is stored. Stop-collars or stop-blocks also make it easier for the die-setter to adjust the shut height of the press to suit the die, in setting up the die in the press.

The die-setter brings the ram down until it rests on the punch-shoe, and then increases the shut-

height of the die 1/32 inch by adjusting the press. The stop-collars are therefore not actually hit or struck at each stroke, but they prevent the die from closing too far, either in storage or when set up in the press. In some cases, such closing would damage the punch and die proper. It might also injure the springs of the stripper if they were continuously compressed more than necessary.

Stock Supports

Stock supports are provided for supporting the stock strip for a short distance in front of the die. The stock support is not necessarily an essential part of the die, since sometimes a device attached to the press or built up from the floor supports the stock.

When provided as part of the die, the support consists of one or two cold-rolled steel bars attached to the die-shoe, as indicated in Fig. 8. The top surface of the support is at a level with the top of the die. A side gage-bar for gaging the stock strip is added on the stock support. The stock support bars are either bent and fastened directly to the top surface of the die-shoe or fastened to a spacer which, in turn, is attached to the top surface of the die-shoe.

A single support bar is used for a narrow stock strip, and two for a wide stock strip. If two are used and the stock is fed from front to rear, the bar on the right should be well inside of the edge of the stock strip, so that the operator can hold the edge of the stock strip while he is feeding it into the die. The direction of feed depends on the type of press being used. An open-side press is usually fed from right to left, and a closed-side press from front to back.

Gages are provided if new strip stock is used for making the parts, the stock being "gaged" at one side and at the end. Gages are omitted if scrap stock is used, in which case the operator must locate the scrap in the die by sight.

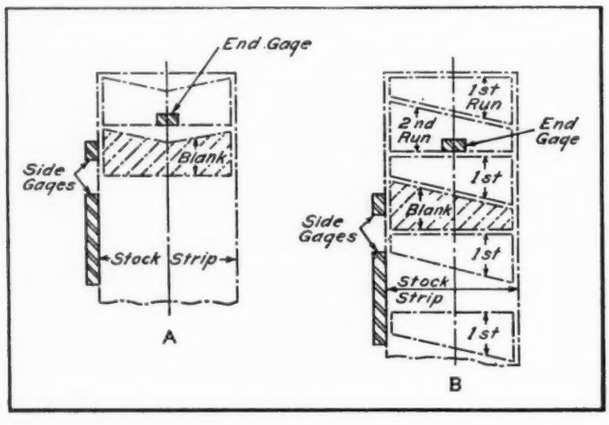


Fig. 9. Location of Gages in Single- and Double-run Dies

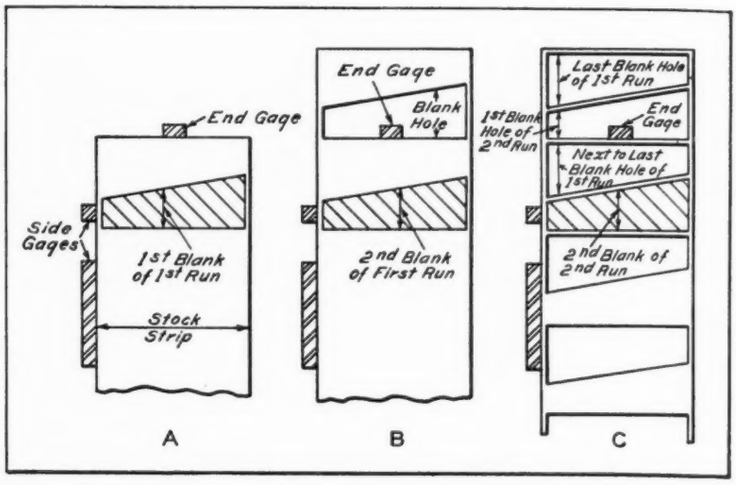


Fig. 10. Gaging Arrangement for Different Conditions: A, Gaging from End of New Stock Strip; B, Gaging from First Blank Hole in Stock Strip; C, Gaging from First Blank Hole of Second Run

One end gage is used for narrow strip stock and two for wide stock. The side gage is at the left side of the die if the stock strip is fed from the front of the press, and at the rear if it is fed from the right side of the press. Extreme accuracy in gaging the stock strip is not important, since the size of the blank is not altered by the gaging. To affect the blank, the location of the stock strip would have to be inaccurate a greater amount than the scrap allowed between the blanks.

There are usually two side gages, one opposite the blanking position, of a bent or welded steel construction, and one as far as possible in front of the blanking position. The latter is usually a pin pressed either into the die-shoe or the side gage-bar on the stock support. The side and end gages are located so that there is about 1/8 inch minimum width of scrap between successive blanks or between the blank and the sides of the stock strip. (The arrangement of side gages may be noted in Fig. 1, page 386, and Fig. 6, page 388, February MACHINERY.)

Locating the Blank to Provide Economy of Stock

Frequently it is necessary to determine the manner in which the stock should be fed through the die so as to use the least amount of stock per blank. Other things being equal, the widest dimension of the blank should be crosswise of the stock strip, in order to use as wide a stock strip as possible. This principle is usually carried out unless by doing so, a larger press than available would be required. Even if a larger press is available, it might not pay to use it on account of the higher operating cost. A stock strip wider than 36 inches should not be used unless necessary, since the price is considerably higher proportionately.

It is easier to feed a wide strip a short distance than a narrow strip a long distance, and also, more

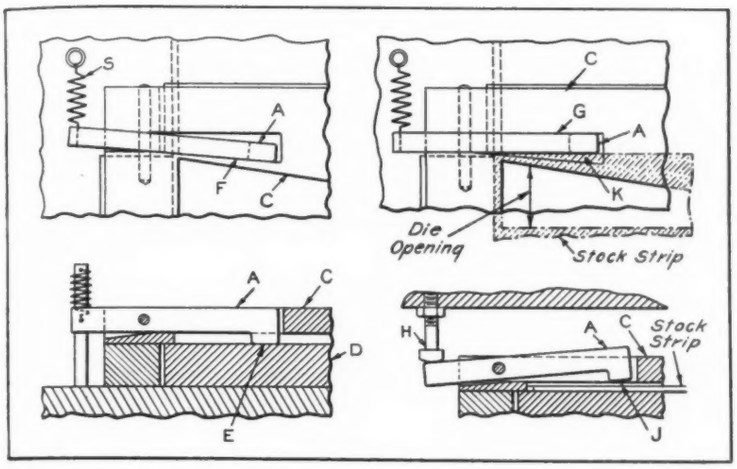


Fig. 11. Views Showing Arrangement and Action of Trigger Type End Gage

blanks can be produced from a wide stock strip. The stock strip cannot be over 120 inches long without paying a premium on the steel. If roll strip stock is to be used, there is practically no limit to the length; but ordinarily, roll stock is only used when an automatic feed is available.

In most cases—for instance, when rectangular blanks are made—the stock strip is run through the die only once, 1/8 inch of scrap being left between the blanks. A die in which the stock strip is fed through the die only once is called a single-run blanking die.

In other cases—for instance, when a triangular blank is made—stock will be saved by running the stock strip through the die twice. Enough space is allowed between successive blanks when running through the first time, as indicated in Fig. 9, so that the strip can be turned over, or end for end, and run through the die a second time. The remaining stock is blanked in a reverse position on the second run. This type of die is known as a double-run die.

In the case of a single-run die, the end gages are located close to the rear blank line (see *A*, Fig. 9). In the case of a double-run die (as at *B*), the end gages are located far enough away from the blank to be cut to allow stock for the blanking of a reverse blank when the stock is run through the die the second time. The gages, of course, operate against the side of the previously blanked hole in the stock strip. They also gage a new strip when the first blank is being made.

The side of the blank that is most nearly square with the side of the stock strip should be at the feeding side of the die. This will be the front side of the die if the stock is fed from front to back. The advantage gained is that the end gages, which gage against the nearer side of the blanked hole of the previous blank, will be gaging that side which is the squarest with the side of the stock strip. (See arrangement of end gages in Fig. 9.) Another advantage is that, in that way, the end gages can most easily be arranged to gage against the square end of a new strip.

If, for some reason, the end gage cannot be used to gage the square end of a new strip, then the operator must "sight" the position of the stock strip for the first blank of a new strip. The usual arrangement is to blank the second blank of the new stock strip as the first blank of the first run. There is then sufficient stock between the first blank of the first run and the end of the stock strip for one blank of the second run. When the stock strip is reversed and fed through the die the second time, the first blank of the strip is blanked. This has the advantage that the square end of the blank is at the end of the strip, which economizes on stock and permits the end gage to act as an end gage for the first blank of the first run. This procedure is indicated in Fig. 10.

A solid stripper is rarely used in place of a spring stripper for a double-run die, since the stock strip is hidden from the view of the operator. If a solid stripper is used on a single-run die, a trigger type end gage can be used to make it unnecessary to lift the stock over the end gage. This also permits limiting the vertical space between the top surface of the die and the bottom of the solid stripper plate to less than twice the stock thickness. The advantage of having a feeding clearance of less than twice the stock thickness is that it prevents the end of a new stock strip from jumping over the end of an old strip when it is used to push the old stock strip through the die.

Trigger Type End Gage

The trigger type end gage, Fig. 11, consists of a lever or trigger *A* pivoted in the solid stripper plate *C*. Normally, the spring *S* holds the trigger stop *A* against the side *F* of the slot in the stripper plate and down in contact with either the stock strip or the die *D* at *E*, depending on which is immediately underneath it.

When a new stock strip is being fed into the die for the first blanking stroke, it comes in contact with the end of trigger *A* which rests on the die at *E*, and pushes the trigger in the direction of the feeding movement until it is stopped by the opposite side *G* of the slot in the stripper plate. The stock is thus stopped or located in the proper position for blanking.

Near the end of the downward blanking stroke, a set-screw *H* in the punch-shoe depresses the outer end of the trigger, lifting the inner end clear of the stock, as indicated at *J*. When the punch ascends, the spring *S* swings the trigger sidewise into contact with side *F* of the slot, so that the trigger falls on the top surface of the stock strip at *K*. For succeeding blanking strokes, the feeding of the stock strip allows the trigger to drop into the blanked opening in the stock and again act as a locating stop when the stock strip is advanced to force it sidewise against side *G* of the slot.

Heat-Treating Chain Links of Unusual Size

By CARL W. SHATTUCK
Chief Engineer, Dover Plant
McKiernan-Terry Corporation

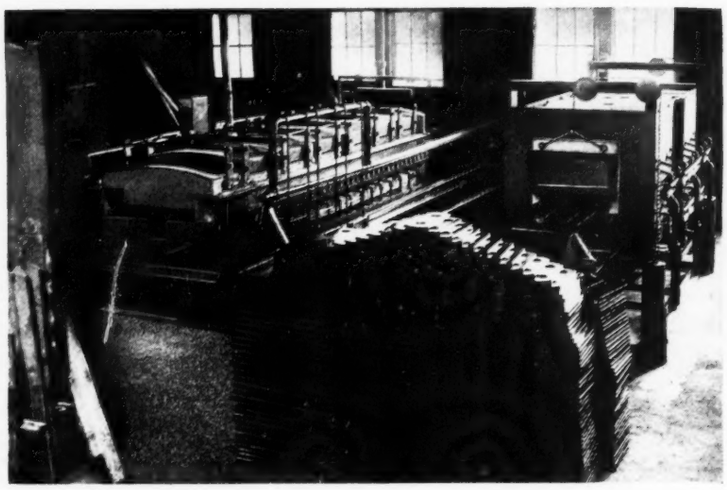


Fig. 1. Roller-hearth Heating Furnace, Quenching Tank, and Tempering Furnace for Heat-treating Unusually Large Chain Links

RECENTLY thirty-two chains of giant proportions were manufactured by the McKiernan-Terry Corporation, Dover, N. J., for raising the spillway gates of the Fort Peck Dam at Fort Peck, Mont. These chains are over 67 feet long and weigh more than 10,000 pounds each. They had to be made to rigorous specifications. The individual links required very precise heat-treatment.

Because of the production involved and the limited time available, the heat-treatment presented a difficult problem. This part of the work was handled by the American Metal Treatment Co., Elizabeth, N. J., who, in turn, had to obtain the services of the American Gas Furnace Co., of the same city, to supply the required heat-treating equipment at short notice. While the American Metal Treatment Co. has some thirty furnaces of various types and sizes in its plant, none of them was adapted to the continuous hardening and tempering process required for these large links. An additional difficulty was presented by the fact that the chains had to be delivered just as quickly as possible, so that it was not feasible to put through all the links of one size and then proceed to the next. It was necessary to jump from one size to another frequently, as the parts were fabricated.

The magnitude of the job will be best appreciated by mentioning that, in all, close to 14,000 parts had to be heat-treated. Of these, over 250 weighed 44 pounds each, almost 600 weighed 32 pounds each, while the remainder weighed from 8 1/2 to 17 pounds each.

The equipment used for heat-treating these chains is shown in the accompanying illustrations. Fig. 1 shows the roller-hearth heating machine or furnace, equipped with a quenching tank. The tempering furnace is shown to the right. Fig. 2 shows the discharge end of the tempering furnace in the foreground and the discharge end of the roller-hearth heating furnace in the background. The heating furnace is of the roller conveyor type, with an available width of 24 inches and a length of 12 feet. The burners are manifolded in three independent sections having automatic control. The furnace is charged by hand.

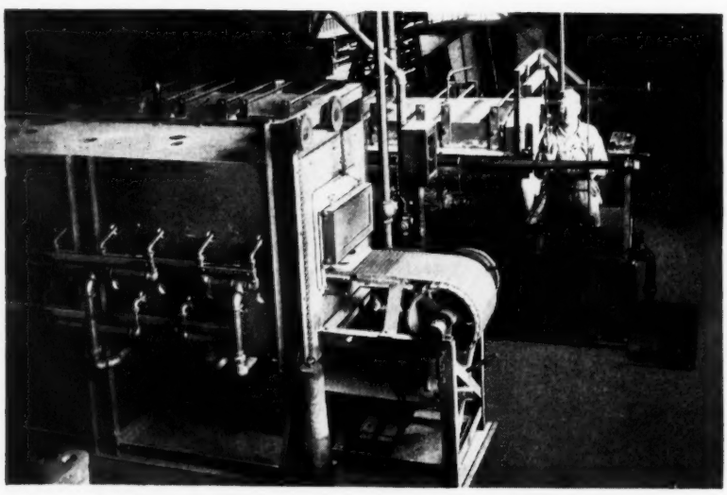


Fig. 2. Discharge End of the Tempering Furnace in the Foreground and of the Roller-hearth Heating Furnace in the Background

The operator who quenches the work removes the links individually, placing them in a specially designed fixture for submerging them in the oil, as indicated in Fig. 2. After quenching, the fixtures are hung on a rack and allowed to remain for a few moments; then they are advanced to the opposite end of the quenching tank, where the links are removed from the fixture, allowed to drain, and placed on the conveyor of the tempering furnace. The quenching tank

is about 15 feet long, 2 feet wide, and 3 feet deep. The oil is held at a steady temperature by means of a circulating pump, with cooling coils located in a sump outside the building. The tempering furnace is of the mesh conveyor type, having an available width of 16 inches and a length of 8 feet. This furnace is over- and under-fired and has automatic temperature control. A particular advantage of the equipment used was the fact that a change could be made from one size of link to another without interrupting the production.

During the operation, links were put aside for Rockwell hardness tests every two hours. These pieces were ground before testing. The steel specified was S A E-3140, which showed an average reading of Rockwell 55 C after hardening. It was possible to hold the hardness of the drawn links within three points on the Rockwell C scale (C-41–C-43).

The Government specifications required that the hardness of the links after drawing be held between the limits of 380 to 420 Brinell. All tests during heat-treatment were made on a Rockwell machine, the drawing temperature being controlled to give a Rockwell C hardness of from C-41 to C-43. These results were checked by the Government inspectors on a Brinell hardness-testing device in a Government laboratory. No rejections were made due to failure of the Rockwell readings to check with the required Brinell hardness figures. The uniform quality of the steel, which was a product of the Bethlehem Steel Co., contributed its share toward the success in meeting these specifications.

The gas consumption varied according to the length of the operating day, which, in turn, was controlled by the work ahead; but a figure as low as 3 cubic feet per pound of work hardened and tempered was achieved, including a prorated portion of the gas required for bringing the furnaces up to the required temperature. The average production was between four and five hundred pounds of work hardened and tempered per hour.

When the job was finished, it was found that, without the benefit of selective assembly, the over-all length of the chain did not vary more than 0.035 inch in the entire length of 67 feet 2 3/4 inches. While credit for this accuracy is primarily due to the grinding of the holes in the links, the heat-treatment and the equipment used for this work are also deserving of considerable credit for keeping the size change in the pieces within such limits as to permit the holes to clean up when grinding. This is especially noteworthy when it is considered that several thousand pieces were treated during several months.

Saving Costs by Welding Gears

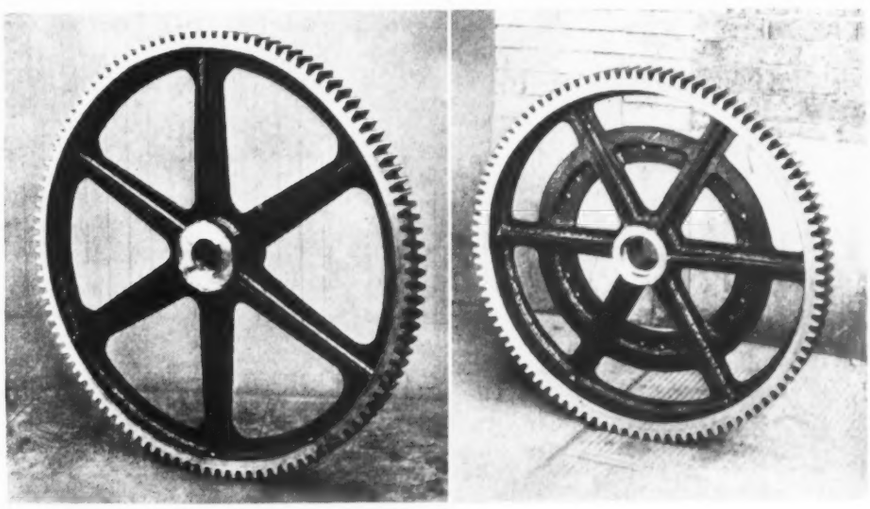
The accompanying illustrations show two gears that were constructed by welding at a saving of approximately one-sixth, as compared with making the gears from castings. The gear shown in Fig. 1 is 48 inches in diameter. In the construction of this gear, as described in *Oxy-Acetylene Tips*, the web and spoke reinforcements were cut from 5/8-inch plate by the oxy-acetylene shape-cutting machine. The web is one piece of metal, with a hole cut in the center for the hub, which was cut from 8-inch round stock. The outer diameter of the web section was accurately cut to fit tightly into the gear ring.

Twelve reinforcing pieces were necessary, two for each spoke. These were fabricated on a quantity-production basis by a cutting machine. To make the hole for the shaft, the hub was first pierced with an oxygen lance. A shape-cutting machine then cut the hole to approximate dimensions, after which the hole and keyway were machined. Fillet welds were employed throughout in assembling the different parts. The spoke section was first welded to the gear-ring, then the hub to the spoke section, and finally the reinforcing pieces to the spokes, gear-ring, and hub.

Fig. 2 shows another example of a welded gear; in this case, however, a ring was required for attaching the gear to another part of the machine. A saving of about one-sixth of the casting cost was made in this instance also, and a gear of high strength and light weight obtained. These examples show what can now be accomplished in welded gears.

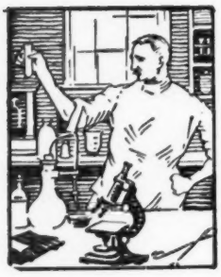
* * *

The production of gold in the United States during 1937 amounted to 4,752,801 fine ounces, having a value of $168,000,000. This amount of gold could have been loaded easily into four railroad freight cars having an average capacity of 50 tons each.



Figs. 1 and 2. Two Gears Constructed by Welding at a Saving of 17 Per Cent over Cast Gears

MATERIALS OF INDUSTRY

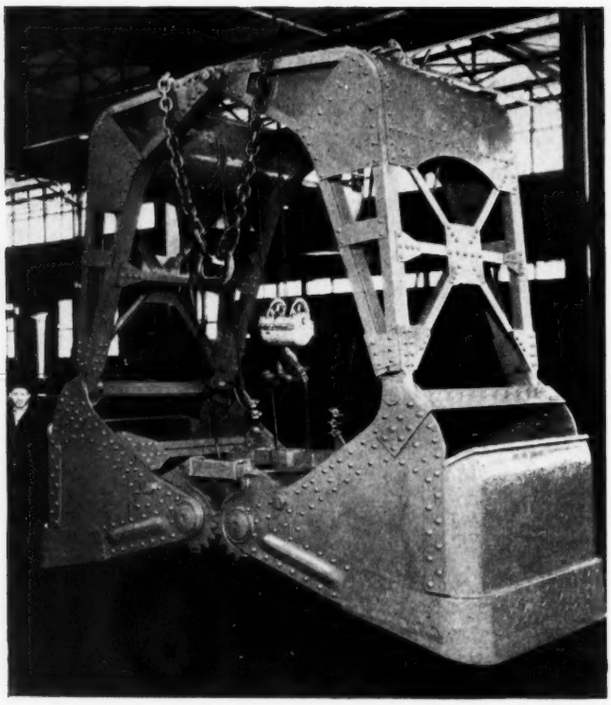


THE PROPERTIES AND NEW APPLICATIONS OF MATERIALS USED IN THE MECHANICAL INDUSTRIES

Alloy Steels Important Elements in Clam-Shell Bucket Design

A clam-shell bucket of giant proportions was recently built by the Blaw-Knox Co., Pittsburgh, Pa., for the Jones & Laughlin Steel Corporation. This bucket, which has jaws and trays made from heat-treated chromium-nickel-molybdenum steel, weighs 22,000 pounds. The steel in the jaws and trays has a tensile strength of 100,000 pounds per square inch and a Brinell hardness at the edges of 350.

The scoop side plates are made from alloy steel having a tensile strength of from 80,000 to 90,000 pounds per square inch, while the hinge and corner castings are made from nickel-vanadium steel and the main hinge pins are of heat-treated S A E-3140 chromium-nickel steel. Bronze bearings of high tensile strength and of 250 Brinell hardness are used for the hinges. 101



Huge Clam-shell Bucket Fabricated from Alloy Steels of High Tensile Strength

Beryllium Copper Bearing Improves Tap Grinding Operation

In grinding small taps, a manufacturer experienced difficulty because the spindle bearing of the chuck in which the taps were held for the operation wore to such an extent that the grinding machine was "down" every six months for replacement of the bearing. Looseness in the spindle of this machine could not be tolerated because of the accuracy required in the finished taps. The load on the spindle was light, and the spindle was merely rotated by hand and at the same time, moved forward and backward, so that the service did not appear to be severe. However, the presence of grinding dust caused wear which introduced play between the spindle and the bearing. Two years ago, a Beryllium copper bearing was adopted for the spindle of this machine, and it has been in constant use ever since without appreciable wear..102

Bronze Lacquer that Produces Metallic Finish on Rubber

It is frequently desirable to give rubber parts or products a metallic finish that will harmonize with the metals in conjunction with which the rubber may be used. To make this possible, the Maas & Waldstein Co., Newark, N. J., has developed a special bronze lacquer for rubber. This lacquer, when applied to semi-stiff rubber produces a strongly adherent, durable finish resembling brass, copper, bronze, aluminum, or steel. It consists of a bronzing liquid to which metal powder of any kind may be added. The mixture is applied by spraying and dries rapidly in the air. 103

Riverside High-Lead Bronzes for Bearing Use

High-lead bearing bronzes of various analyses, designed for different applications, are being introduced on the market by the Riverside Foundry

To obtain additional information about materials described on this page, see lower part of page 460.

& Galvanizing Co., Kalamazoo, Mich. The group includes a bronze containing 78 per cent copper and 22 per cent lead, which is intended for use with heat-treated shafts, spindles, journals, etc., provided with adequate lubricating facilities. The same grade of bronze is cast into seal rings for mechanical refrigerators and similar requirements.

A bronze of 74 per cent copper and 26 per cent lead is available for the bearings of unhardened shafts lacking in lubrication. There is also a bronze of 72 per cent copper and 28 per cent lead for use with water and lighter liquids, as well as a bronze of 80 per cent copper and 20 per cent lead, for making lead-screw nuts, shoes, yokes, etc. 104

Draftsmen's T-square and Parallel Straightedge Made of Stainless Steel to Prevent Warping

Novel Applications of Stainless Steel

There seems to be no end to the varied uses for which stainless steel is adapted. According to the *Electromet Review*, published by the Electro Metallurgical Co., 30 E. 42nd St., New York City, sponges are now being made of one continuous filament of stainless steel, spun in such a manner that even vigorous rubbing with the sponge will not cause scratching of highly polished surfaces. These sponges have been brought out specifically for the efficient cleaning of metal containers.

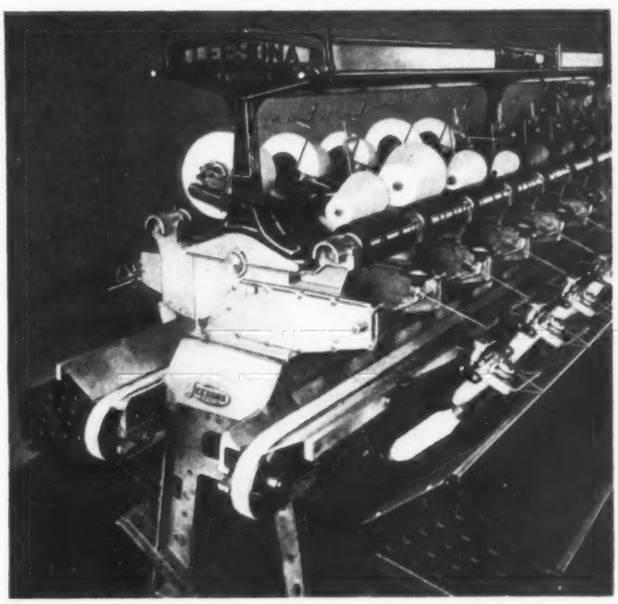
Because these sponges eliminate scratches on container walls in which bacteria might be harbored, they have proved helpful in maintaining a low bacteria content in milk and other food products. They enable hard or incrusted particles of food to be removed so quickly that it is unnecessary for the user to subject his hands to prolonged immersion in hot water. The immunity of the stainless steel to the rusting action of warm water is also of importance in applications of this sort. The smooth ductile filaments of the sponge are always free from rust and from broken, scratching ends.

Another novel application pointed out by the *Electromet Review* is the use of stainless steel by Turner Devices, Inc., St. Louis, Mo., for making draftsmen's T-squares and parallel straightedges. The rustproof, non-warping properties of stainless steel and its rigidity when properly formed make the material especially suitable for drafting equipment of this type. The thin cross-section of the stainless steel T-squares and straightedges is also an advantage. Permanent straightness of the transparent edges is said to be insured by the stainless steel strips.

Springs are being increasingly made of stainless steel because of the ability of this metal to resist abrasion, corrosion, and high temperatures, in combination with its high tensile strength and resiliency. Some stainless steel springs are of extremely small dimensions, while others are capable of supporting heavy vibratory loads. Long service is obtained without plating or painting.

Another unusual application of stainless steel is in the fabrication of large all-welded bellows for use in steam-line expansion joints made by the Foster-Wheeler Corporation, New York City. This stainless steel construction eliminates the need for adjustments or maintenance, and there is no packing to be tightened from time to time. These joints are designed for service pressures of from 200 to 600 pounds per square inch and temperatures up to 750 degrees F.

Other evidences of the increasing popularity of stainless steel are the use of this material in the escalator steps of the International Casino, New York City's most recent night club, and its application in sixteen-passenger cable cars for transporting mountain climbing tourists and skiers in the Italian Alps from one resort to another....105



As Many as Fifty Zinc Die-cast Gear-housing Assemblies are Used on this Rotor Coner, Each of these Units Weighing Over Twenty Pounds. Photograph, Courtesy Doehler Die-Casting Co.

To obtain additional information about materials described on this page, see lower part of page 460.

NEW TRADE LITERATURE

Recent Publications on Machine Shop Equipment, Unit Parts and Materials. To Obtain Copies, Check on Form at Bottom of Page 459 the Identifying Number at End of Descriptive Paragraph, or Write Directly to Manufacturer, Mentioning Catalogue Described in the March Number of MACHINERY

Electric Equipment

WESTINGHOUSE ELECTRIC & MFG. Co., East Pittsburgh, Pa. Circular B-2130, entitled "Electric Drive Selector and Hints on Maintenance," illustrating and describing, in a simple, non-technical way, the requirements that must be met in selecting a motor. Pamphlet describing a line of push-buttons for heavy-duty service on alternating- and direct-current pilot circuits. Pamphlet B-2118, entitled "Five Point Protection against Explosion and Corrosion with Westinghouse De-Ion Oil-Immersed Motor Starters." 1

Bronze Bearings

JOHNSON BRONZE Co., 520 S. Mill St., New Castle, Pa. Catalogue 380, containing 64 pages of complete information on the line of bearings, bushings, and bar bronze made by this company. The catalogue covers general-purpose bearings, universal bronze cored and solid bars, electric motor surface bearings, lead-base and tin-base babbitt, cast-bronze graphited bearings, etc. 2

Metal Hose and Couplings

PACKLESS METAL PRODUCTS CORPORATION, 37 Twenty-ninth St., Long Island City, N. Y. Bulletin 100, containing specifications and descriptive matter covering Packless seamless flexible metal hose; detachable self-sealing couplings; vibration absorbers for pipe and copper tube lines; combination tube and hose coupling; etc. 3

Welding Instructions

UNITED STATES STEEL CORPORATION SUBSIDIARIES, 434 Fifth Ave., Pittsburgh, Pa. Booklet entitled "Welding Instructions and Standards—Part I," dealing primarily with methods of showing welding on drawings by the American Welding Society's new symbol system. First of a series of booklets treating of all phases of welding. 4

Coordinate Drawing Paper and Cloth

KEUFFEL & ESSER Co., Hoboken, N. J. Booklet entitled "Graph Sheets —Coordinate Papers and Cloths," covering the various types of ruled drawing and tracing paper and cloth made by the concern for use in making graphic charts and for other designing purposes. 5

Industrial Measuring Instruments

CARL ZEISS, INC., 485 Fifth Ave., New York City. Catalogue Fe 200, covering the complete line of Zeiss industrial measuring and gaging equipment, including gear testers, screw-thread measuring instruments, measuring microscopes, etc. 6

Welding Equipment

LINCOLN ELECTRIC Co., 12818 Coit Road, Cleveland, Ohio. Application Sheet No. 58 in a series dealing with Machine Design, describing the application of welding in the design and assembly of elementary units and the combination of these units into a completed part. 7

Hydraulic Punching and Stripping Units

PROGRESSIVE WELDER Co., 737 Piquette Ave., Detroit, Mich. Bulletin 3803, on Progressive hydraulic punching and stripping units which can be positioned to operate at any angle, for performing punching operations on curved or irregular-shaped forms. 8

Gear-Cutting Equipment

NATIONAL BROACH & MACHINE Co., Shoemaker and St. Jean, Detroit, Mich. Circular entitled "Accurate Silent Gears at Lower Cost," illustrating and describing Red Ring gear-finishing machines, lapping machines, universal gear testers, and gear noise testing machines. 9

Hardness Testing Instrument

LOUIS C. EITZEN Co., 280 Broadway, New York City. Folder descriptive of the Brinell meter, a portable apparatus for the accurate determination of the hardness and strength of ferrous and non-ferrous metal products, independent of their dimensions. 10

Welding Equipment

PROGRESSIVE WELDER Co., 737 Piquette Ave., Detroit, Mich. Bulletin 3802, describing the important points in the design of Progressive portable hydraulic welding guns and equipment, and showing a few applications in actual manufacturing jobs. 11

Lighting Equipment

GENERAL ELECTRIC VAPOR LAMP Co., 893 Adams St., Hoboken, N. J. Booklet entitled "Mercury Light for Better Sight," describing the new combination Cooper-Hewitt incandescent lamps and their uses in industry. 12

Tool-Room Lathes

LODGE & SHIPLEY MACHINE TOOL Co., Cincinnati, Ohio. Catalogue 488-I-137, illustrating and describing Lodge & Shipley 12-, 14-, and 16-inch belt- and motor-driven tool-room lathes and attachments. 13

Precision Lathes

SOUTH BEND LATHE WORKS, 721 E. Madison St., South Bend, Ind. General catalogue No. 97, illustrating and describing the company's complete line of back-geared, screw-cutting, metal-working precision lathes. 14

Speed Reducers

CLEVELAND WORM & GEAR Co., 3255 E. 80th St., Cleveland, Ohio. Catalogue 200, containing complete information on the Cleveland line of worm-gear speed reducers and their application for various purposes. 15

Heat-Treating Equipment

LEEDS & NORTHRUP Co., 4921 Stenton Ave., Philadelphia, Pa. Circular on the Vapocarb Hump method of hardening and its application in hardening blanking dies in actual service. 16

Gear Shapers

FELLOWS GEAR SHAPER Co., Springfield, Vt. Circular describing the design of the "face gear" produced on Fellows gear shapers, and its application to angular and offset drives clutches, etc. 17

Corrosion-Resistant Alloys

HAYNES STELLITE Co., Kokomo, Ind. Booklet entitled "Hastelloy—High-Strength Alloys for Corrosion Resistance," containing complete information on the four Hastelloy alloys. 18

Speed Reducers

CHARLES BOND Co., 617 Arch St., Philadelphia, Pa. Catalogue Ga-60, illustrating and describing the various types of Bond stock speed reducers, including the recently introduced B type double-reduction units. 19

Variable Reducer Transmission

STEPHENS-ADAMSON MFG. Co., Aurora, Ill. Catalogue 68, descriptive of the variable reducer transmission made by this concern, which comprises a combination speed changer and speed reducer. 20

Metallographic Equipment

BAUSCH & LOMB OPTICAL Co., Rochester, N. Y. Catalogue E-225, on this company's line of metallographic equipment and accessories for use in commercial laboratories and educational institutions. 21

Drop-Hammers

PNEUMATIC DROP HAMMER Co., Boston, Mass. Catalogue illustrating and describing a new pneumatic double-lift gravity drop-hammer for stamping and forming sheet-metal parts and hollow ware. 22

Inclinable Power Presses

JOHNSON MACHINE & PRESS CORPORATION, 620 W. Indiana Ave., Elkhart, Ind. Circular containing specifications on B & J No. 3 inclinable power presses. 23

Stainless Steels

RUSTLESS IRON & STEEL CORPORATION, 3400 E. Chase St., Baltimore, Md. Handbook of Rustless stainless steels, covering straight-chromium and chromium-nickel steels. 24

Gear-Chamfering Machines

CIMATOOL Co., Dayton, Ohio. Catalogue describing Cimatool precision gear-tooth chamfering, burring, and milling machines. 25

Electric Switches

GENERAL ELECTRIC Co., Schenectady, N. Y. Bulletin GEA-1565B, illustrating and describing alternating-current magnetic reversing switches. 26

Presses

VERSON ALLSTEEL PRESS Co., 93rd St. and South Kenwood Ave., Chicago, Ill. Catalogue descriptive of various styles of Verson all-steel welded presses. 27

Pumps

FAIRBANKS, MORSE & Co., 600 S. Michigan Ave., Chicago, Ill. Bulletin 6185, illustrating and describing Fairbanks-Morse duplex self-oiling power pumps. 28

Air Compressors

INGERSOLL-RAND Co., 11 Broadway, New York City. Catalogue 3426, descriptive of Ingersoll-Rand electric-driven, direct-connected compressors. 29

Corrosion-Resistant Coating

AMERICAN CONCRETE & STEEL PIPE Co., Los Angeles, Calif. Circular descriptive of "Amercoat," a corrosion-proof sprayable plastic coating for concrete, steel, and wood. 30

Bearing Bronzes

RIVERSIDE FOUNDRY & GALVANIZING Co., Non-Ferrous Division, Kala-

---

To Obtain Copies of New Trade Literature

listed on pages 458-460 (without charge or obligation) mark with X in squares below, the publications wanted, using the identifying numbers at the end of each descriptive paragraph; detach and mail to:

MACHINERY, 148 Lafayette St., New York, N. Y.

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	

Name ..... *Position or Title* .....

[This service is for those in charge of shop or engineering work.]

Firm .....

Business Address .....

City ..... *State* .....

[SEE OTHER SIDE]

mazoo, Mich. Circular entitled "This is Our Story on High-Lead Bearing Bronze." 31

Expansion Reamers

BARBER-COLMAN CO., Rockford, Ill. Circular illustrating and describing the Masterall positive adjustable expansion reamer. 32

Grinding Wheels

NORTON CO., Worcester, Mass. Circular descriptive of the Norton line of newly improved grinding wheels for foundry use. 33

Abrasive Sheets

BEHR-MANNING DIVISION OF NORTON CO., Troy, N. Y. Simplified price list of coated abrasives, arranged with index for ready reference. 34

Electrodes

METAL & THERMIT CORPORATION, 120 Broadway, New York City. Booklet containing data on Murex heavy coated electrodes. 35

Rebuilt Machine Tools

EASTERN MACHINERY CO., 1000 Tennessee Ave., Cincinnati, Ohio. List No. 38 of rebuilt machine tools, including prices. 36

Bench Lathes

STARK TOOL CO., Waltham, Mass. Circular on the new Stark integral drive precision bench lathe. 37

The Undistributed Profits Tax from a Business Man's Point of View

In the February number of *Harper's Monthly Magazine*, Maurice Wertheim, of Wertheim & Co., in pointing out the unsoundness of the Undistributed Profits Tax legislation from every point of view, says:

"To pay one's debts first, to lay something by for a rainy day, to expand out of earnings, and to be conservative in the payment of dividends, are elementary rules of sound business, handed down from father to son for too many generations in American industry to have men suddenly comprehend that they are wrong. There is an impression in Washington that business is capitalizing the 'recession' to get modification of the Undistributed Profits Tax. Washington never made a greater error. The objection to the undistributed profits tax is fundamental, and nothing can change the American business man's conviction that its basic principle is wrong.

"In this quarrel between business and government, the Undistributed Profits Tax may have assumed larger proportions than even its own great importance warrants. It seems to have become a miniature Court Bill ... The reason is not far to seek. Business confidence depends today, not on trade statistics, not even on balanced budgets. The sacred price of gold could almost be called secondary. The reason that business is waiting so breathlessly for the answer that will be made to the problem of the Undistributed Profits Tax is that it fears that the Government is willing to sacrifice even the soundest of business principles in favor of extending its control over our economic life."

* * *

Unusual Plastics Exhibit at Museum of Science and Industry

The story of the development of an idea into a material, and of a material into a great industry, will be vividly presented at an exhibit at the Museum of Science and Industry, Rockefeller Center, New York City, from March 1 to 31, inclusive. This exhibit will include a reproduction of a corner in the little laboratory in Yonkers, N. Y., where, in 1907, Dr. L. H. Baekeland developed Bakelite resinoid, a discovery that marked the beginning of the plastics industry. The growth of the industry is illustrated in an interesting way by a series of exhibits which indicate what an important part plastics play in modern life. These exhibits show how plastics enter into the construction of almost all modern mechanical devices. At the end of the month, the exhibit will move to other cities.

To Obtain Additional Information on Shop Equipment

Which of the new or improved equipment described on pages 461-482 is likely to prove advantageous in your shop? To obtain additional information or catalogues about such equipment mark with X in the squares below, the identifying number found at the end of each description on pages 461-482—or write directly to the manufacturer, mentioning machine as described in March MACHINERY.

51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73
74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96

Fill in your name and address on other side of this blank.

To Obtain Additional Information on Materials of Industry

To obtain additional information about any of the materials described on pages 456-457 mark with X in the squares below, the identifying number found at end of each description on pages 456-457—or write directly to the manufacturer, mentioning name of material as described in March MACHINERY.

101	102	103	104	105

Fill in your name and address on other side of this blank.

Detach and mail to MACHINERY, 148 Lafayette St., New York, N. Y.

[SEE OTHER SIDE]

Shop Equipment News

Machine Tools, Unit Mechanisms, Machine Parts, and Material-Handling Appliances Recently Placed on the Market

Brown & Sharpe Electrically Controlled Grinding Machines

The new 20 series plain grinding machines being placed on the market by the Brown & Sharpe Mfg. Co., Providence, R. I., represent a complete departure from previous designs in that they are operated entirely by electrical control. These machines are self-contained manufacturing units designed for the cylindrical grinding of medium-large parts on a production basis. The operating functions of all major units are governed by the simple manipulation of various selector switches and control knobs, which are grouped at the front of the machine.

Once the machine has been set for a given job, it can be controlled entirely by the cross-feed handwheel. Turning one selector switch provides a semi-automatic grinding cycle, whereby a slight rotation of the cross-feed handwheel advances the wheel to the work and simultaneously brings the headstock table, cross-feed, and coolant pump into operation. When the work has been ground to size, the cross-feed is automatically disengaged, and rotation of the handwheel to the starting position withdraws the wheel and stops the headstock, table, and coolant pump.

Two control knobs provide for manual operation. Turning the table knob starts and stops the table; and pressing the knob down will cause the table to stop at the end of its travel when desired. The headstock knob starts and stops the headstock and coolant pump together; and by turning a selector switch, this knob can also be made to start and stop the table movement. When it is desired to inspect the work, depressing the headstock knob will stop the flow of coolant without affecting the headstock rotation, and the same control can be used to jog or rotate the headstock slowly in loading and removing the work.

Other features include an electrically controlled table dwell, which is adjustable from 0 to 1 1/2 seconds; electrical braking and reversal of the table motor, which gives smooth, accurate table reversal; individual motor drive for wheel-spindle, headstock, table, oil-pump, and coolant pump; and the simplification and safety of operation gained by inter-connection of the control circuits.

The capacity of the No. 20 machine is 10 by 18 inches, the maximum swing over the table being 10 3/4 inches. A 24-inch wheel clears work up to 10 inches in diameter and a 30-inch wheel work up to 6 inches in diameter. The No. 22 machine is identical with the No. 20, except that it has a longer bed and table and takes work up to 36 inches between centers. These machines are furnished for either alternating- or direct-current power supply, and require about 18 horsepower for operation at maximum capacity.

The headstock speeds range from 80 to 120 revolutions per minute, and the rates of table travel are in two ranges, 15 to 60 inches and 75 to 300 inches per minute. In addition, extra slow rates of table travel of 7 and 11 inches per minute are provided. The headstock and table are driven by separate direct-current motors, controlled by rheostats which provide practically any desired rates of travel within the given limits.

B & S Electrically Controlled Cylindrical Grinding Machine

To obtain additional information on equipment described on this page, see lower part of page 460.

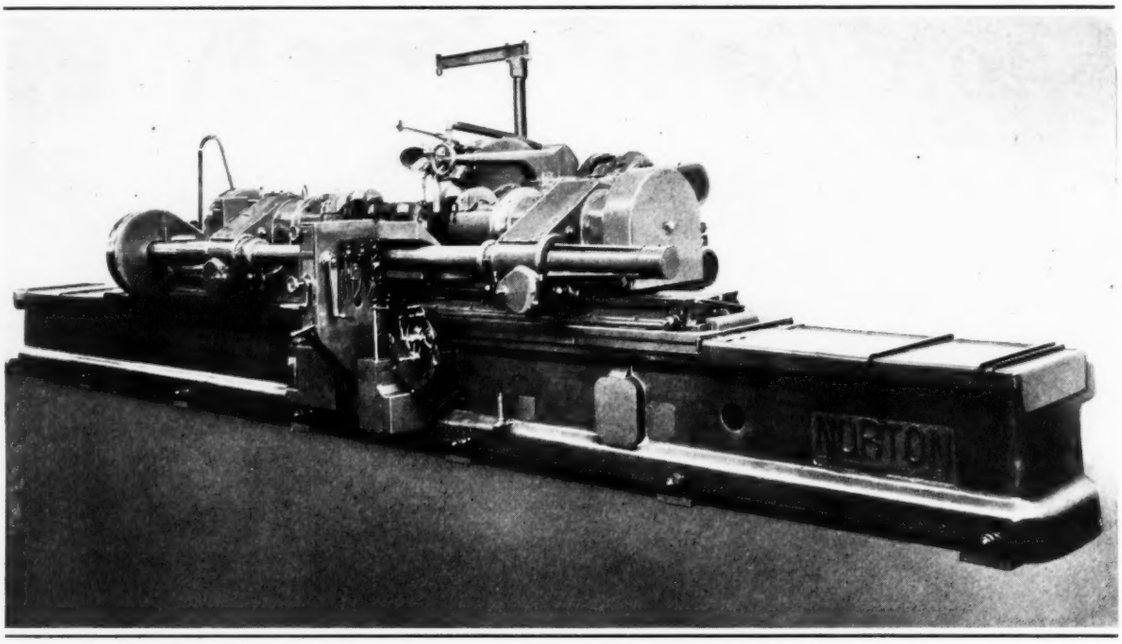


Fig. 1. Norton Crankpin Grinding Machine for Large Crankshafts

The motor-generator set which supplies direct current to these motors is located in a compartment in the rear of the machine bed.

The drive to the wheel-spindle is by a multiple V-belt from a motor mounted on the wheel-slide, change sheaves giving speeds of 825 and 1035 revolutions per minute. The phosphor-bronze spindle boxes can be easily and uniformly adjusted while the spindle is running to prevent the application of excessive pressure. Other mechanical features include manual or automatic adjustment of the cross-feed throw-out to 0.0001 inch; automatic lubrication of the wheel-spindle, wheel-slide ways, cross-feed and table mechanisms, and table ways by gravity flow of filtered oil supplied by a motor-driven pump.

These machines can be furnished with a revolving spindle headstock having low work speeds ranging from 46 to 185 revolutions per minute; a wheel-spindle reciprocating arrangement; and wheel-slide rapid travel arrangement. The latter device provides for greater speed, convenience, and safety in loading and unloading work.—51

Norton Crankpin Grinding Machine for Diesel-Engine Crankshafts

A heavy-duty, 24-inch, double-head grinding machine has been designed by the Norton Co., Worcester, Mass., for grinding the crankpins of crankshafts for Diesel, truck, tractor, and marine engines that are too large to be ground on standard automotive crankpin grinders. With this machine, all the crankpins on a shaft can be ground without removing the shaft from the machine. The work-heads can be moved along the table to accommodate crankshafts of any length within the capacity of the machine. Loading and unloading are facilitated by steps built on the front of the machine. Interlocking devices and convenient controls provide for safe and efficient operation.

Power for driving the work is transmitted from the motor at the left end of the table to a point midway between the work-heads. The drive-shaft then drives each work-head spindle through sprockets and silent chains, thus equalizing the driving torque and preventing excessive strain on the crankshaft. Each work-head runs in two pairs of special anti-friction bearings, and an adjustable counterweight on the end of the work-heads balances the shaft. The heads are moved along the table as required by means of a rack and pinion, driven through reduction gears.

A rapid wheel-head traverse is combined with a shoulder feed in an independent mechanism which moves the upper portion of the compound wheel-slide by means of a special screw and half-nut. Two speeds are available, a shoulder feed of 1 inch per minute and a rapid traverse of 50 inches per minute.

A two-point bearing steady-rest is attached to the machine base. The steadyrest shoes can be quickly drawn back from the table in traversing the table or loading or unloading the machine. Interlocking features prevent the table from being moved when the steadyrest shoes are in the grinding position, shown in Fig. 2. The interlocking system also prevents the work from being revolved except by "jogging" when the shoes are backed out of position.

To obtain additional information on equipment described on this page, see lower part of page 460.

The main functions of the machine are controlled by one lever and two handwheels. Both the wheel unit and the table can be moved rapidly or slowly. The table cannot be moved at its rapid speed while the wheel is between the two cheeks of a pin, and it cannot be moved at all when the power wheel-head traverse is in use. A small handwheel is employed for moving the wheel along its axis to "split the spark" as the wheel begins to grind the shoulders of the pin. This handwheel is mounted on a swiveling extension arm, which can be pushed aside when work is being placed in the machine.

A set of push-buttons is provided which enables the operator to jog the work rotation; start and stop the work-heads; start and stop the grinding wheel; and start and stop the coolant pump. The feeding of the wheel is controlled by a handwheel, and the diameter to which the crankpin is ground is controlled by the grinding gage shown in Fig. 2, which can be swung upward to clear the crankshaft.

The table is moved rapidly from one grinding position to the next as successive pins are ground, but is decelerated by the operator through the main control lever as the pin approaches the grinding position. The table is located by means of pointers spaced to correspond with the centers of the crankpins and the pointer on the base directly opposite the center of the grinding wheel. Direct motor drive is provided for each of the following units: The grinding wheel spindle; the power table traverse; the work drive; the power wheel-head traverse; the coolant pump; and the force-feed lubrication pump.

The machine is equipped with grinding wheels up to 42 inches in diameter and swings work 24 inches in diameter over the table. The maximum distance between the heads is 120 inches. The machine occupies a floor space of about 11 by 38 feet, and weighs about 50,000 pounds, with standard equipment and motors. 52

Bradford Six-Unit Automatic for Drilling, Reaming, and Tapping Steering-Knuckle Arms

Automobile steering-knuckle arms used in "knee action" or independent front-wheel suspension type mountings are drilled, reamed, and tapped at the rate of 150 pieces an hour on a six-unit automatic machine recently developed by the Bradford Machine Tool Co., 657 Evans St., Cincinnati, Ohio. The principal feature of this machine is that it handles both right- and left-hand arms simultaneously, producing alternately rights and lefts, 75 pieces of each hand being machined per hour.

Previous methods of machining these parts required separate machines for the two different hands, since their opposed angularity made it impossible to complete all the holes in one set-up. These methods, besides requiring more operators, also had the disadvantage that an equal number of rights and lefts seldom went

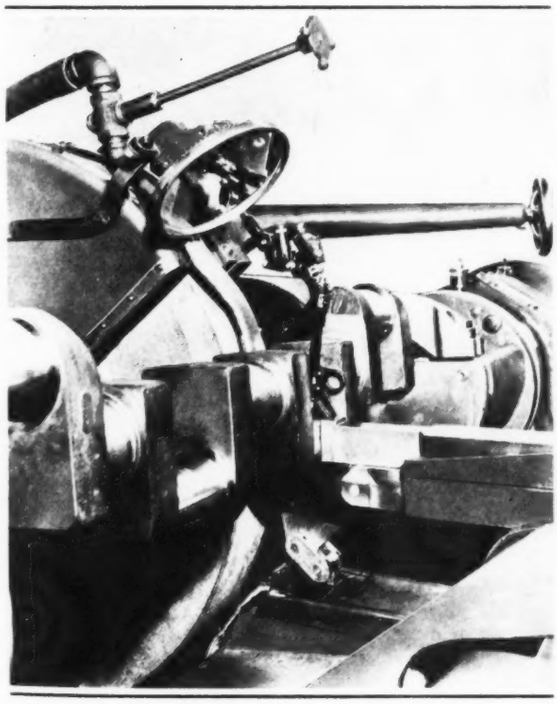
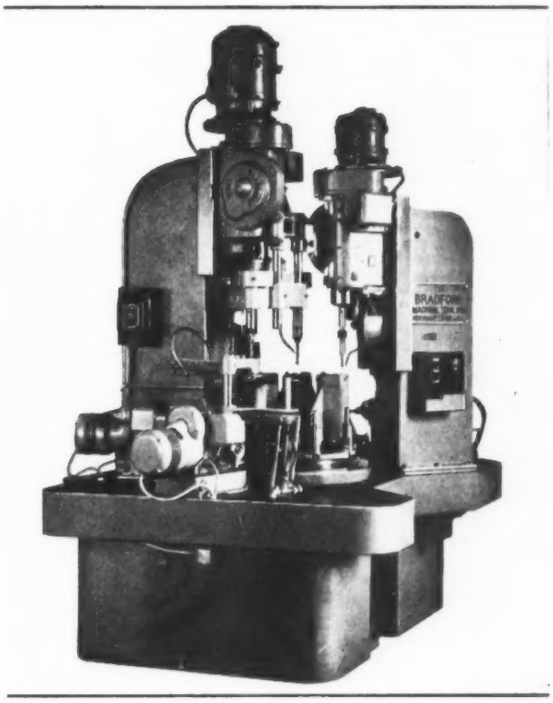


Fig. 2. Close-up View of Steadyrest, Gage, Mirror, and Coolant Control of Machine Shown in Fig. 1



Bradford Automatic Machine for Handling Right- and Left-hand Parts Simultaneously

To obtain additional information on equipment described on this page, see lower part of page 460.

down the line, there being usually more of one than the other.

The new machine is principally of welded steel construction, and consists essentially of a box type base with a built-in coolant reservoir, supporting six Bradford automatic drilling units, grouped about a six-station horizontal indexing fixture that holds twelve parts, or a right- and left-hand part at each station.

The four horizontal units drill at three stations and ream at the final station. The vertical operations are handled by two units; the larger one has three spindles, two drilling and one counterboring, while the smaller single-spindle unit taps by the use of a reversing motor.

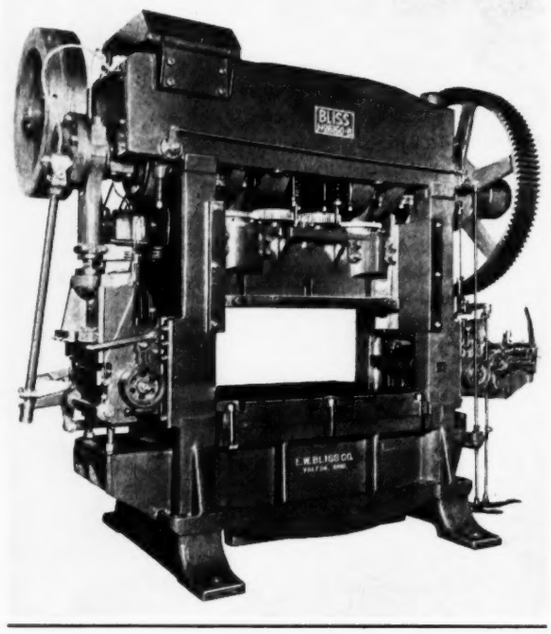
Electrical control and synchronization of the machine are obtained through limit switches, relays, magnetic contactors, etc., and a large control panel incorporated in the base. All of the electrical equipment and wiring is built into and is an integral part of the machine. The operator's control is centered in the push-button station on the column near his right hand.....53

Bliss Press Designed for High Production

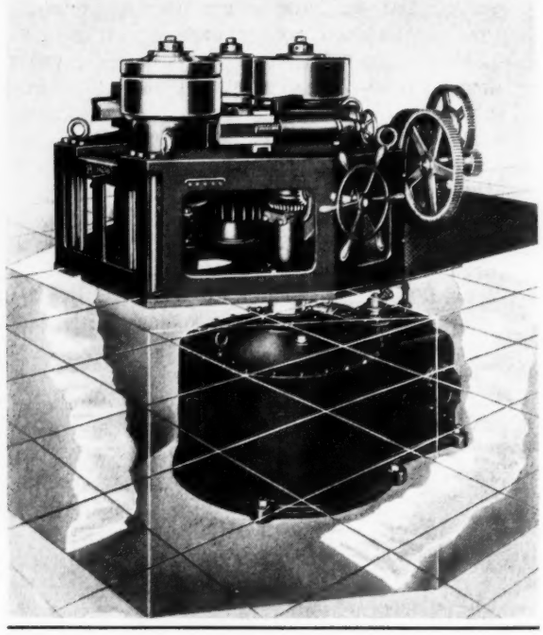
A high-production press, with a capacity rating of 150 to 190 tons, designated No. 6150-B, has recently been added to the line of the E. W. Bliss Co., 53rd St. and Second Ave., Brooklyn, N. Y. This new machine is arranged to operate at 30, 45, and 60 strokes per minute by the use of a 15-horsepower multiple-speed motor which drives the flywheel through V-belts.

The clear distance between the press uprights is 60 inches, and the bed is 36 by 60 inches. The crankshaft is of the double eccentric type, and is 6 1/2 inches in diameter at the bearings. The slide has a stroke of 4 inches and the shut height on the bed is 24 inches. All main bearings are lubricated by an automatic force-feed system.

The double roll-feed is 18 1/2 inches wide and is adjustable for any feed length from 0 up to 15 inches per stroke. Other feed lengths and types of feeds are available. Combined with the feed, is a seven-roll power-driven straightener and a shear type scrap-cutter. 54



Heavy-duty Press with Double Roll-feed, Built by the E. W. Bliss Co.



Buffalo Horizontal Bending Rolls with Drawing Unit in Closed Pit below the Floor

Buffalo Horizontal Bending Rolls

Improvements recently incorporated in the No. 3 horizontal bending rolls built by the Buffalo Forge Co., Buffalo, N. Y., include a main roll drive directly coupled through a Morse chain flexible coupling to the verticle shaft of a Jones speed reducer. The chain coupling has a tight aluminum housing which is filled with grease. The vertical worm-Maag-spur gear reducer takes the entire reduction in a single self-contained housing, with all gears and bearings running in a bath of oil. The drive unit is located in a closed pit below the floor.

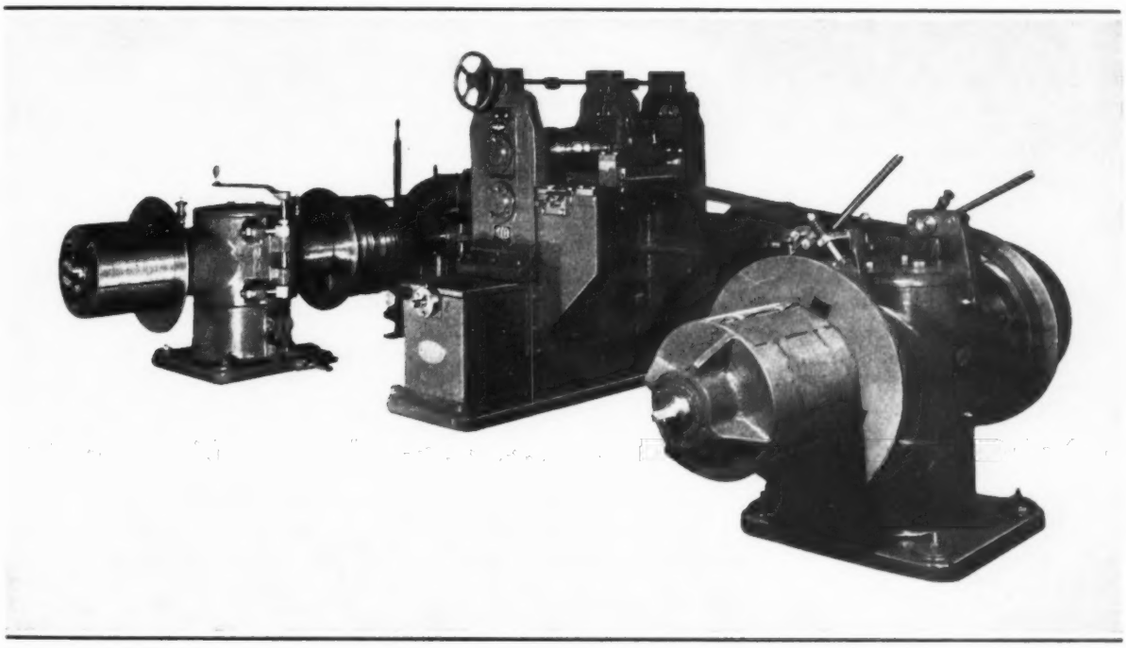
A built-in oil-pump on the reducer unit circulates oil over the gears and bearings. The flexible couplings used on both the motor and drive side deliver power directly to the roll pinion-shaft, cushioning the impacts resulting from the frequent re-

To obtain additional information on equipment described on this page, see lower part of page 460.

versal of the rolls. An adjustable roll can be had with a power adjustment effected by a compact, geared arrangement with a reversible motor and controls. The motor is mounted on the floor plate and the whole assembly covered with a guard. 55

Yoder Side-Trimming and Slitting Equipment for Coiled Stock

To facilitate the uncoiling, slitting, processing, and rewinding of coiled material, the Yoder Co., W. 55th St. and Walworth Ave.. Cleveland, Ohio, has developed uncoiling and tension units having two or more drums so arranged that one drum can be easily swung into line with the cutters or other processing machines while the other drums are being loaded or unloaded. The accompanying illustration shows an installation for uncoiling, slitting, edge-trimming, and coiling or rewinding flat material. It consists of three units, the uncoiling reel stand at the right, the slitting and edge-trimming machine in the center, and the tension reel at the left.



Yoder Three-unit Equipment for Uncoiling, Slitting and Rewinding Flat Stock

While the material on the drum in line with the slitting machine is being uncoiled, it is securely held in place by a positioning block in the base of the coiler. The drum is swung out of or into position by the operator, who releases the position-locking device by depressing a foot-lever and by simultaneously moving a hand-lever, thus releasing the braking device which permits the drum support to revolve freely on its base. When the drum is swung out of line with the other machines, it is free to be loaded or unloaded.

All the drums that make up this multiple uncoiling unit are equipped with adjustable drag brakes. These brakes allow the drums to "pay off" the material at the proper slitting tension, and at the same time prevent over-runs when the processing train is suddenly stopped.

The slitting and edge-trimming machine shown in the illustration between the uncoiling and coiling units is equipped with a combination entering guide, hold-down, and wiper attachment. This equipment guides the material into the slitter and simultaneously cleans it and places a drag upon the stock as it is being slit. The machine shown is set up for slitting narrow strips, using solid cutters and spacers as shown. This machine is adaptable to many uses. For instance, when it is set up for side-trimming, housing-mounted cutters can be used; and by means of a simple screw adjustment, the width of the trimmed stock can be varied as required. The top and bottom cutters can be quickly moved without changing their relative adjustments.

The tension reel at the rear of the slitting machine is also of the two-drum type. The driving mechanism is a unit separate from the coiling drum unit, and is connected to the drum that is swung into line with the slitting machine by a simple pull on a hand-lever which engages the coupling mechanism. The drum that is swung out of line with the slitting machine is easily accessible for the wiring of the coils and their removal from the collapsed drum. 56

To obtain additional information on equipment described on this page, see lower part of page 460.

Ex-Cell-O Precision Facing Machine

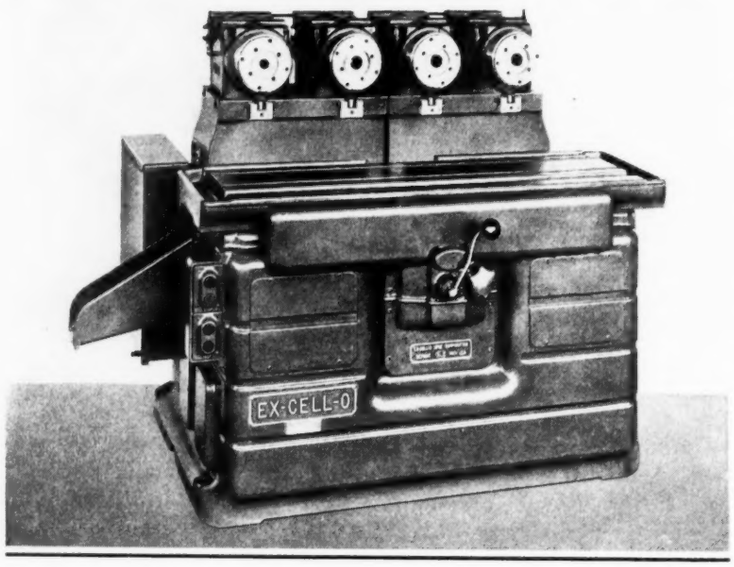
A new machine for facing, turning, and grooving operations, equipped with any required number of spindle units from one to six, inclusive, has been added to the line built by the Ex-Cell-O Corporation, 1212 Oakman Blvd., Detroit, Mich. The new machine is similar to the precision-boring machines made by this company, the chief difference being that the spindle units are located at right angles to the work-table travel. The precision ball-bearing spindles and the hydraulic system of operation and control, are the same as on the boring machines.

This new machine is suitable for facing pump bodies, clutch hubs, valves, and miscellaneous flat surfaces; also for such operations as turning rabbets or grooves in motor end-shields and milling compressor cylinder face slots. Any of these operations can be performed in small lots or on a production basis.

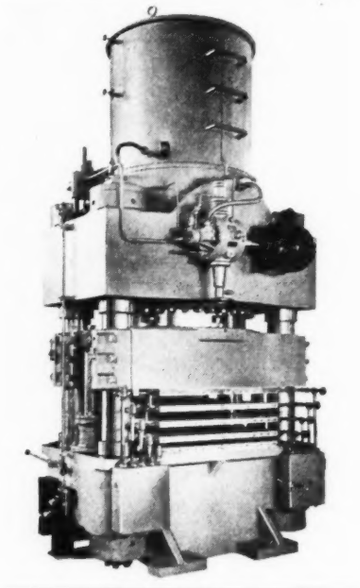
The driving motors can be mounted above, beside, or below the spindles, depending on the number and type of spindles used. When only two spindles are required, the motors can be mounted on the bridge beside the spindle units. The work-table has a variety of feeds and its traverse is operated and controlled by a hydraulic cylinder. Adjustable dogs, located on the front of the table, automatically control the rapid traverse and the location and length of the table feed. The work can be rotated by the spindles or held stationary on the table. An adapter, arbor, or hand- or air-operated chuck can be used to clamp the work to the spindle nose. A manually or hydraulically operated fixture can be used to hold the work on the table.

A chip chute between the table and bridges can be arranged to direct chips to either side of the machine. A coolant reservoir is cast in the machine base and a coolant pump can be driven by the main motor. For dry machining operations, a suction system can be installed to carry away the chips.

The machine table has a fixture pad 15 1/2 inches by 44 inches. The center distance between the table ways is 9 1/4 inches. The maximum table travel is 12 inches; rapid traverse, 12 feet per minute; and feed, 1 to 23 inches per minute. This machine requires a floor space of 56 by 73 inches. 57



Ex-Cell-O Precision Facing, Turning, and Grooving Machine



Hot-plate Press Developed by the Hydraulic Press Mfg. Co.

1500-Ton Hydro-Power Hot-Plate Press

The hydro-power hot-plate press of 1500 tons capacity here illustrated is a recent development of the Hydraulic Press Mfg. Co., Mount Gilead, Ohio. This press is of the vertical downward-acting open-rod type, having a closed-top pedestal bed. The platen is actuated by one main ram and two auxiliary "Fastraverse" rams. The pressing surface of the platen and bed is 48 by 48 inches. Five 2-inch thick hot plates, 48 inches square, are located between the platen and the bed at equal distances from each other.

The "Fastraverse" operating system includes a radial pump, directly connected to an electric motor and mounted overhead on the press. This arrangement makes the machine completely self-contained. The open circuit system, with manual and automatic time press travel control, and the single-stage hydropower unit are especially suited for sustained pressure service. The press is adapted for compressing or curing relatively thin materials in sheet or board form which require the applica-

To obtain additional information on equipment described on this page, see lower part of page 460.

tion of both heat and pressure as employed for laminated paper stock impregnated with a resinous binder, plywood with a glue film, and hard-finished building boards, etc. 58

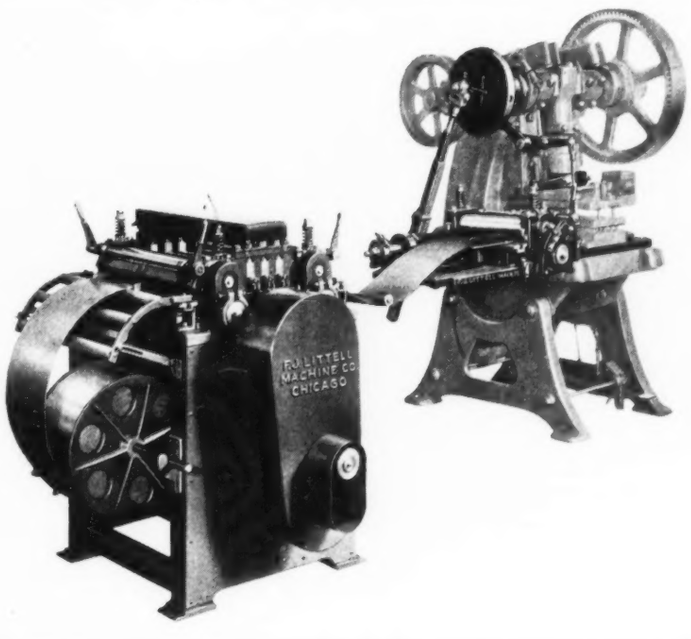
Littell Power-Driven Continuous Straightening Machine

A double power-driven variable-speed straightening machine designed for straightening stock before it is fed into a punch press has been developed by the F. J. Littell Machine Co., 4149 Ravenswood Ave., Chicago, Ill. This machine provides continuous straightening through the use of a variable-speed drive. It is made for use on such materials as soft aluminum, brass, and copper which quickly take a "set" when run through the straightening rolls intermittently.

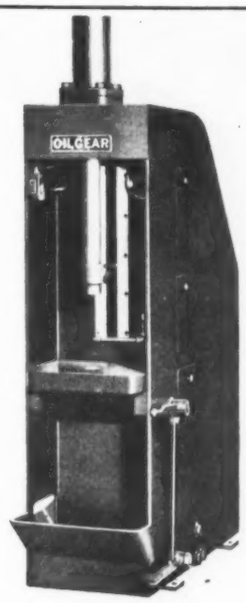
The upper straightening rolls of the new machine can be adjusted individually or as a unit. The power-driven feeding rolls at the front and back of the straightening rolls and the power-driven lower straightening rolls facilitate starting the material through the machine, which has sufficient power to handle wide and comparatively heavy stock.

The coil-holder attached to the machine can be used when the coils are of relatively small diameter, thus saving floor space. An apron supports the soft stock and prevents it from kinking. The machine is automatically controlled by a mercoid switch, so that if the press is stopped, the straightening machine will stop automatically.

The illustration shows the material being fed into a press fitted with an intermittent cut-off die. This die can be set to cut at every stroke or at any number of strokes, and this, combined with a variation in the length of feed, permits pieces of almost any length from 1 to 10 feet to be cut. This cut-off arrangement can be adapted to a wide variety of work. 59



Press Equipped with Littell Continuous Straightening Machine and Intermittent Cut-off Die



Oilgear Side-plate Press Adapted for Broaching and Assembling Operations

Oilgear Fluid-Power Side-Plate Presses

A line of fluid-power side-plate presses made in constant and variable ram speed types, designated PEC and PED, respectively, has been brought out by the Oilgear Co., 1302 W. Bruce St., Milwaukee, Wis., for use in assembling and broaching operations. These machines are made in 3-, 6-, 10-, and 15-ton capacities. They are of rigid, all-steel side-plate construction, with fully enclosed operating mechanism and built-in oil and lubricant reservoirs.

The controlled fluid power generated by Oilgear constant- or variable-displacement pumps provides smooth, positive, high-speed ram motion. 60

Wayne Metal Coating for Protection Against Welding Spatter

To eliminate the necessity for chiseling, filing, scraping, and cleaning welding spatter from the parts adjacent to welds, the Wayne Chemical Products Co.,

To obtain additional information on equipment described on this page, see lower part of page 460.

9502 Copeland, Detroit, Mich., has brought out the Wayne metal coating. It is claimed that this coating lessens the chance of hot metal particles damaging gears and moving parts in axles and other machine housings.

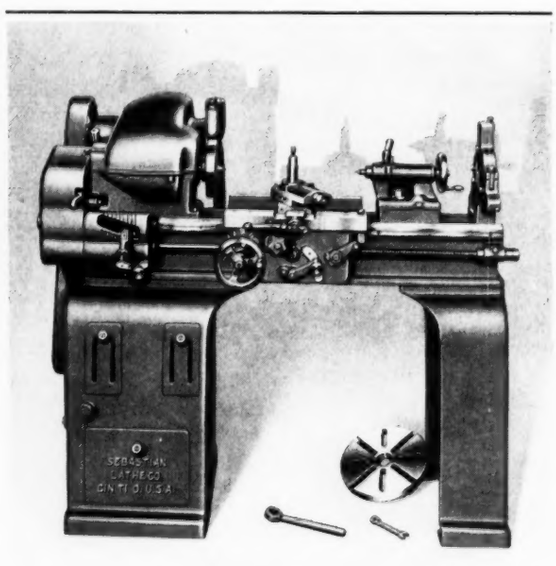
This metal coating is furnished in the form of a very light jell which may be applied by brushing, dipping, or spraying. It contains water and instantly cools the hot welding sparks as they hit the metal, preventing them from attaching themselves to the covered surface. The parts treated with this coating can be easily cleaned with hot water or a cleaning solution. 61

Sebastian "Stremeline" Lathe

A lathe of compact design, streamlined to give a well balanced appearance, which embodies new mechanical features has been brought out by the Sebastian Lathe Co., Cincinnati, Ohio. This lathe is made in three sizes having swings of 10, 12, and 13 inches. All three sizes have an underneath motor drive, the motor being enclosed in the machine leg.

All moving parts are guarded. The guard over the headstock spindle is so arranged that it automatically releases the belt tension to permit belt-shifting when it is lifted and places the tension back on the belt when lowered into position. Lifting the guard also breaks the electrical circuit to the motor, thereby preventing the motor from being started accidentally. Another safety feature prevents both feeds in the apron from being engaged at the same time. There is also a safety shear pin.

These lathes have feeds ranging from 0.00175 to 0.111 inch, and will cut from 3 to 384 threads per inch, either right- or left-hand. The apron is also provided with a reverse for the feeds. The apron is of double-plate construction and has a friction feed. There is a power cross-feed. The compound rest is graduated. The tailstock is also graduated and there are also set-over graduations at the rear. The collet capacity for the spindle nose type is 1 5/16 inches, and draw-in type, 7/8 inch. 62



Sebastian "Stremeline" Lathe with New Mechanical and Safety Features

Michigan Gear-Finishing Machines

A new gear-finishing machine designated the 860 will be exhibited by the Michigan Tool Co., Detroit, Mich., at the coming Machine and Tool Progress Exhibition at Detroit. This machine, shown in Fig. 1, is of the single rotary cutter type and operates on the same basic crossed-axis principle as the rack type gear-finishers made by this company. It is much smaller than the rack type finishers, and is intended for use where the high-production capacity and versatility of the larger machines are not required.

Fig. 1. Michigan Single Rotary Cutter Type Gear-finishing Machine

The cutter and gear rotate in mesh, but about different axes, so that as they rotate, there is a sliding action diagonally across the face of the gear tooth. Serrations in the cutter teeth faces, on both sides of the cutter teeth, shave off excess material. The gear to be finished is placed in the machine on an arbor or between centers. Pushing the control button causes the cutter to rotate and drive the gear. As the cutter revolves, the table carrying the cutter is fed away from the operator toward the rear of the machine until the cutter has passed the point where the center distances between the cutter and gear reach the minimum. At this point, the gears are properly sized and the table feed is reversed automatically, carrying the cutter back toward the front of the machine. This completes the cycle and the machine

To obtain additional information on equipment described on this page, see lower part of page 460.

stops automatically for reloading.

This machine is available in two types, one type finishing gears up to 8 inches in diameter, while the other handles gears up to 12 inches in diameter. The machine is driven by a three-horsepower motor having a speed of 1200 revolutions per minute. The weight of the machine is approximately 4600 pounds.

Another gear-finishing machine, known as the new model "Duplex," has recently been brought out by this company. The Duplex machine, shown in Fig. 2, is designed for use where it is desired to finish both extremely large as well as small gears on a single machine, or two gears simultaneously, as required in the case of cluster gearing. This machine will also finish both sides of a herringbone gear simultaneously. The two independent rotary cutters are universally adjustable. Two handwheels provide independent adjustment for height and two independent lateral settings for controlling the size, while individual worm and wheel adjustments provide for the crossed-axis setting of each cutter.

The work is mounted with the axis located vertically between centers, and is fed away from the operator, passing between the two crossed-axis cutters. The cutters are preset to the correct center distance for finishing the gears to exact size. At the end of the stroke the feed reverses, returning the work between the cutters to the starting position. The machine then stops automatically for reloading. The entire cycle is automatic and controlled by a push-button. Both cutters can be used for finishing the same gear, if desired, thereby increasing production. 63

Semco Universal Piercing Dies

A group of standard universal piercing die sets has recently been added to the line of Semco utility dies for sheet-metal work made by the Service Machine Co., 162 Miller St., Elizabeth, N. J. This group of dies includes three standard styles, Models A, B, and C, intended for single-hole piercing in large sheets or small parts. The illustration shows the Model A with a standard gage table. The table is standard on the Model A only. The Models B and C have a single back and end gage.

The Model A will take any punch size from 1/8 to 3 1/2 inches in diameter. The Model B will take punches from 1/8 inch to 2 1/4 inches in diameter, while the Model C is intended for punches from 1/8 to 9/16 inch or from 1/4 to 3/4 inch. Slots or punches and dies of special shape can be accommodated in these sets within their diameter range. Semco punch and die sets are used for the largest sizes, while Cleveland Steel Tool Co.'s punches and couplings are used for the small- and medium-size ranges. Stripper-plate adapters are furnished for each punch size. The necessary bushing adapters for dies are supplied with the set. Punches and dies can be readily interchanged, and the stripper plates slide out with the punch. 64

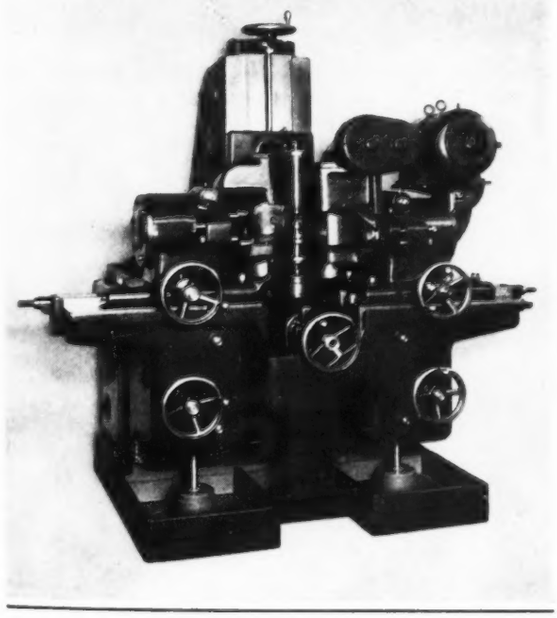
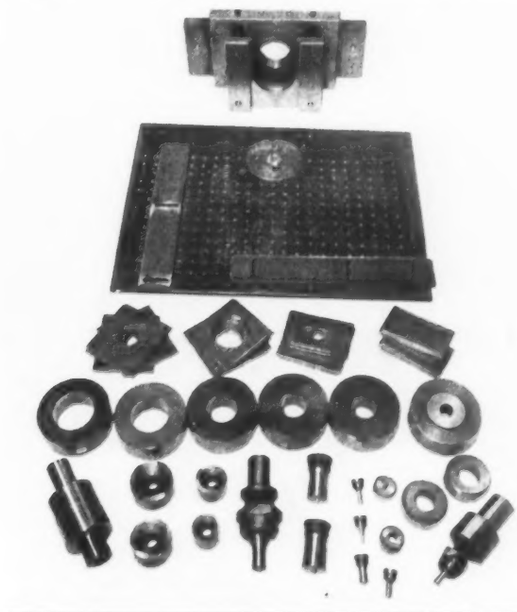


Fig. 2. Michigan Duplex Gear-finishing Machine Designed to Finish Two Gears Simultaneously



Universal Piercing Die Set with Gage Table, Brought out by the Service Machine Co.

To obtain additional information on equipment described on this page, see lower part of page 460.

Fitchburg Vertical Planetary Type Internal Grinder

A vertical planetary type of machine designed for grinding the holes of parts difficult to handle and to rotate has been developed by the Fitchburg Grinding Machine Corporation, Fitchburg, Mass. The cycle of this machine is automatic from loading to unloading, including work-clamping, grinding, and sizing. The control is electro-hydraulic throughout, and the movements are so interlocked that one motion cannot take place unless the previous one has been completed. The operator's only duties are to see that the work is properly located in the loader and to trip the control.

The speed of the wheel-assembly rotation is controlled by a hydraulic motor which provides variable speeds. Three inches of wear on the wheel diameter are permissible because of the 1 1/2-inch eccentric movement. The wheel-spindle is driven by a three-horsepower motor.

The entire hydraulic control is contained in one unit, including the tank. There are four oil circuits driven by two dual pumps, and a five-horsepower motor. One circuit has a balancing control that serves as a counterweight for the vertical reciprocation of the wheel-head.

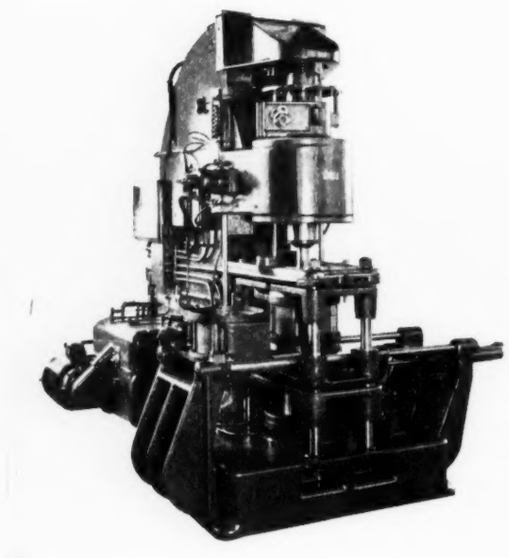
The fixture design depends upon the work, and it can be hydraulically operated, if desired. The fixture illustrated is for holding electric motor stators and is equipped with a hydraulic ram and ring compressors for holding the laminated stators under heavy pressure. This machine weighs 16,000 pounds. 65

Oilgear Gooseneck Straightening and Broaching Presses

A fluid power gooseneck straightening press, designated Type PR, has been brought out by the Oilgear Co., 1302 W. Bruce St., Milwaukee, Wis. This new press is built in seven sizes, with capacities ranging from 25 to 200 tons. The sensitive control of the variable ram movement obtained by the Oilgear drive permits the ram to be brought into contact with the work without impact and to deflect the piece the desired amount without over-running.

The work can be indicated quickly and accurately for straightness while on the table. The convenient hand-lever and foot-pedal control enables the operator to select the down and return ram speeds independently, to vary the ram speed at will, and to reverse or stop the ram movement at any time.

Standard resistance blocks, spring centers on roller carriages, or overhanging spring centers on the bar are available. Tables shorter or longer than the standard lengths and in either plain or grooved types can be made to suit requirements. Two sizes of the Oilgear Type DH variable-displacement pumps are available for each size of press. One provides economical, variable ram speeds for general straightening purposes, and the other provides higher variable ram speeds to meet high-production requirements.



Fitchburg Vertical Internal Grinder with Hydraulic Control

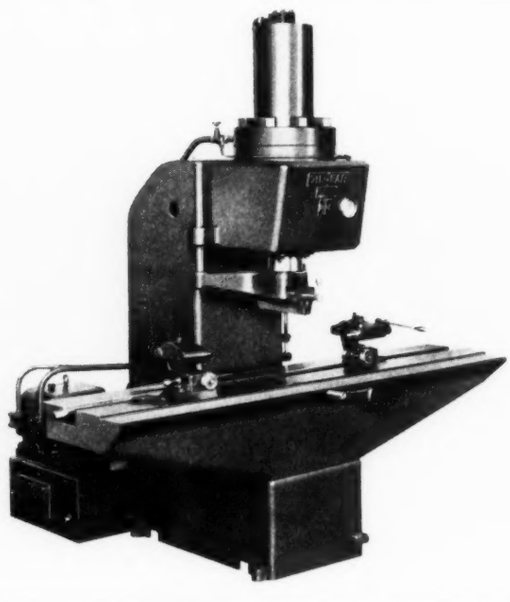


Fig. 1. Oilgear 200-ton PR Gooseneck Straightening Press

To obtain additional information on equipment described on this page, see lower part of page 460.

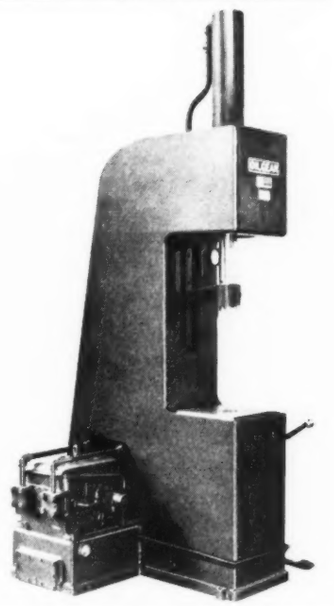


Fig. 2. Type PG 20-ton Press for Broaching, Stamping, etc.

The power fluid automatically lubricates the pump and press parts.

Another line of gooseneck presses, made in two types designated PG and PGR, and in five sizes ranging from 6 to 25 tons capacity, has also been added to the line made by this company. These presses are designed for forcing, broaching, assembling, and straightening operations. They have variable ram speeds with sensitive control.

The Type PG presses have plain platens, of convenient working heights, as shown in Fig. 2. These presses are especially suited for broaching, forcing, stamping, and general manufacturing. The finished platen has a large working surface with a hole bored through it directly under the ram.

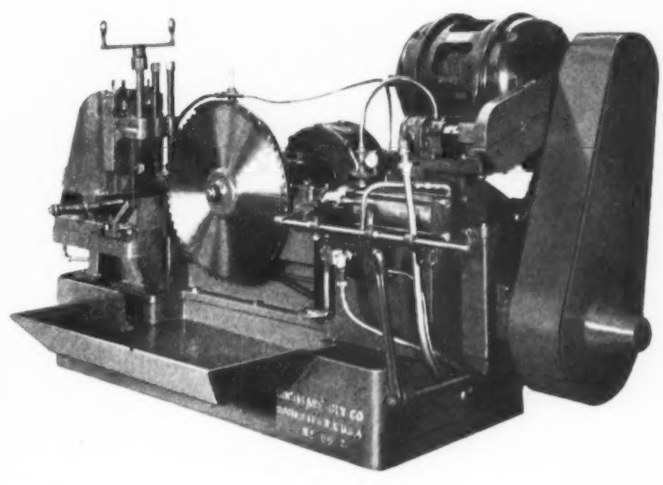
The Type PGR presses have low platens and large "daylight" capacities. They are made to accommodate detachable tables and fixtures. Spacer tables, work-tables, and straightening tables of convenient working heights, widths, and lengths, together with suitable fixtures, can be furnished to meet production requirements. A detachable fixture or table can be rebuilt or changed to suit changes in parts, operations, or production requirements. When used for assembling operations, the cushioned power quickly presses mating parts to predetermined dimensions against positive stops or shoulders. For broaching operations, the power is applied at the center of the broaching tool.

Manual hand-lever and foot-pedal control is standard equipment on both styles of presses. Semi-automatic hand-lever and foot-pedal control is also available. Depressing the hand-lever or foot-pedal causes the ram to move downward at a pre-set speed to a predetermined point and then return to the starting position. This cycle occurs automatically, but can be interrupted at any point. Two sizes of Oilgear variable-displacement pumps are available for each size of press. One provides economical variable ram speeds for general manufacturing purposes, and the other variable ram speeds intended to meet high-production requirements. 66

Cochrane-Bly Non-Ferrous Billet Saw

A machine recently developed by the Cochrane-Bly Co., 15-21 St. James St., Rochester, N. Y., for sawing billets, tubes, and bars of aluminum, brass, and other non-ferrous metals up to 9 inches in diameter, is similar in appearance but of larger size than the machine described in April, 1937, MACHINERY. The new machine has a sliding gear transmission that provides four cutting speeds of approximately 250, 370, 485, and 600 feet per minute. A self-contained hydraulic unit gives feeds from 0 to 100 inches per minute. Adjustable stops provide an automatic trip for the carriage movement in both directions and actuate the rapid-return traverse.

The chip pan is of large dimensions to accommodate the chips, which accumulate very rapidly because of the high operating speeds of the machine. Sloping sides facilitate removal of the chips from the pan by means of a hoe or shovel. The compound-toggle hydraulically operated clamp is equipped with two adjustable clamp screws. The 30-inch diameter blade of this machine will cut through a 7-inch brass or aluminum billet in five seconds. 67



Cochrane-Bly Saw for Cutting Tubes and Bars of Brass, Aluminum, etc., up to 9 Inches in Diameter

To obtain additional information on equipment described on this page, see lower part of page 460.

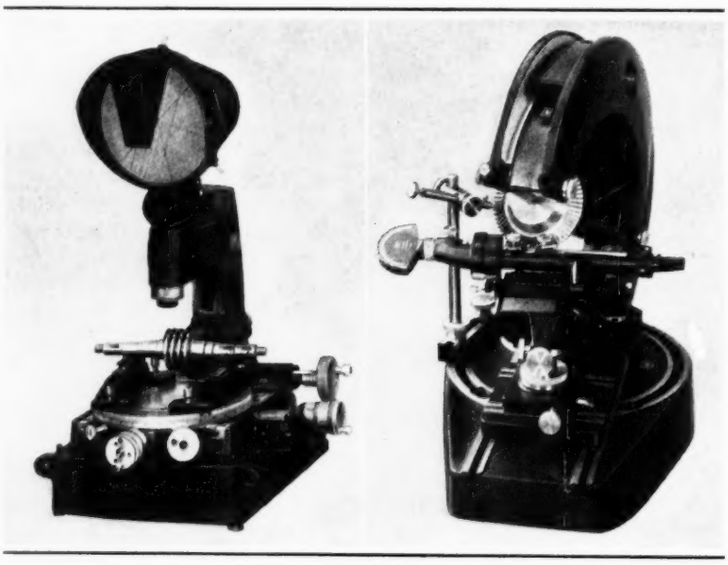


Fig. 1. (Left) Zeiss Toolmaker's Microscope with Projector
Fig. 2. (Right) Improved Gear-testing Machine

Zeiss Precision Measuring and Testing Instruments

A large toolmaker's microscope, equipped with a projector as shown in Fig. 1, is one of four new or improved precision instruments recently brought out by Carl Zeiss, Inc., 485 Fifth Ave., New York City, which will be on display in the Zeiss exhibit at the American Society of Tool Engineers' convention, Detroit, Mich., March 9 to 12.

This measuring instrument is adapted for use in the production and inspection of thread gages, taps, dies, hobs, worms, templets, and form tools. It has a built-in, rotary graduated table, with a longitudinal travel of 6 inches and a transverse travel of 2 inches. It is provided with an inclined eye-piece and has oculars with various contour templets that are readily interchangeable. The magnifications are 10X, 15X, 30X, and 50X.

The improved gear-testing machine or instrument shown in Fig. 2, designed to furnish accurate analyses of individual gear errors by checking component elements rather than by showing the sum total of all errors, is also being placed on the market by this company. Inspection of gears with this instrument is accomplished by checking the base circle pitch, tooth thickness, and concentricity.

The instrument is extremely rigid and permits readings to an accuracy of 0.00005 inch. Two Orthotest indicators are built into the instrument. The supporting frame will accommodate gears up to 16 inches in diameter. For larger gears, the measuring slide can be used separately. All kinds of gears, including spur, helical, bevel, hypoid, and worm gears can be tested.

The Zeiss Co. also announces the new precision instrument shown in Fig. 3, which is designated an "optical circular table." This instrument is particularly suitable for indexing and dividing work of all kinds, especially jig boring on large and heavy work. A graduated glass circle and reading microscope is employed to insure a high degree of accuracy.

Another Zeiss instrument of improved design is the camshaft tester shown in Fig. 4. This instrument is intended to provide a rapid, high precision means for determining the form and angular relation of the lobes of cams of all kinds. Direct readings can be made on the glass master scale and spiral optical vernier to 0.00005 inch. This device is adapted for a wide range of applications in the manufacture of camshafts for automobiles and for Diesel and airplane motors, chiefly in checking master cams, although it can also be used in the production line for periodic checking. 68

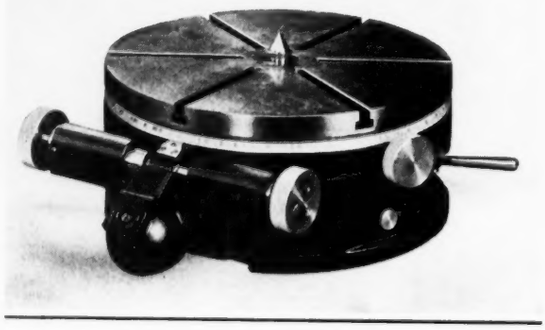


Fig. 3. Zeiss "Optical Circular Table"

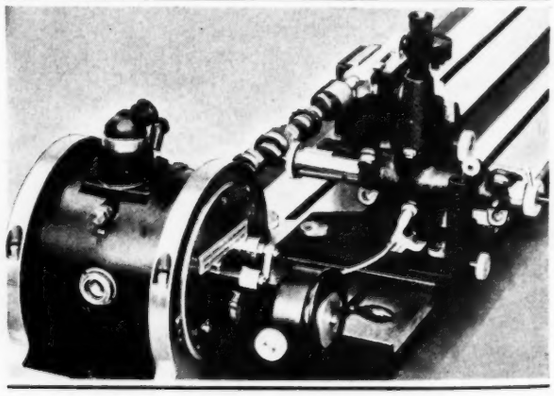


Fig. 4. Improved Camshaft Tester

To obtain additional information on equipment described on this page, see lower part of page 460.

Landis Receding Circular-Chaser Collapsible Tap

A receding chaser collapsible tap, designated Style CBLM, in which a circular type chaser is employed, has been developed by the Landis Machine Co., Inc., Waynesboro, Pa. This tap has been designed for the production tapping of line pipe, casing, and drill pipe couplings in tube mills on the types of tapping machines generally used for this class of work. It will produce threads well within all API tolerance specifications, and can be used for tapping couplings made from seamless Grade C or D steel, welded steel, or wrought iron.

The head of the tap is detachable, permitting several sizes of heads to be used on one body. The standard No. 6 CBLM body can be fitted with heads covering a thread range of from 4 1/2 to 13 3/8 inches outside diameter. The standard body will cut an actual thread length of 5 5/8 inches, as required for API couplings, including Grade D, long-casing couplings.

The tap is expanded by a short movement of the crank-handle, operating through a rack and pinion to bring the tripping ring into contact with the face of the coupling. This brings the receding mechanism into operation as the tap is fed into the coupling. The crank-handle controls the manual movements of the housing, and is fitted with a latch, so that the housing and the trip-ring can be moved back and locked out of the way to permit replacing the chaser slides. The tap can be adjusted to collapse automatically at any predetermined length. The tripping ring is of the reservoir type having provision for directing the lubricant directly over each chaser.

The tap can be adjusted to cut any degree of taper from 0 to 3/4 inch per foot. The chasers are mounted on slides held in slots milled in the face of the head. The head and slides are hardened and ground all over. A separate set of slides is required for each thread diameter. Accurate size is maintained by a positive self-locking arrangement. Means are provided for making any predetermined amount of adjustment for size. The changing of chasers in the head does not appreciably affect the size. When mounted on their slides, the chasers can be rotated to bring the cutting edge into any desired position with respect to the center. This makes it possible to adjust the cutting clearance as required by the kind of material being cut. 69

Landis Collapsible Tap with Circular Chasers

Reaming Machine Adapted for Chamfering and Tapping

A machine for reaming, chamfering, burring, tapping, and special milling operations, designated No. 3, has been brought out by the Hole Engineering Service, 307 Stormfeltz-Loveley Bldg., Detroit, Mich. This machine will be exhibited at the coming Machine and Tool Progress Exhibition at Detroit, Mich. The heat-treated alloy steel spindle is mounted in precision ball bearings and is fitted with an enclosed flywheel designed to prevent chatter. The spindle has a No. 3 Morse taper and can be equipped with a draw-bar when required.

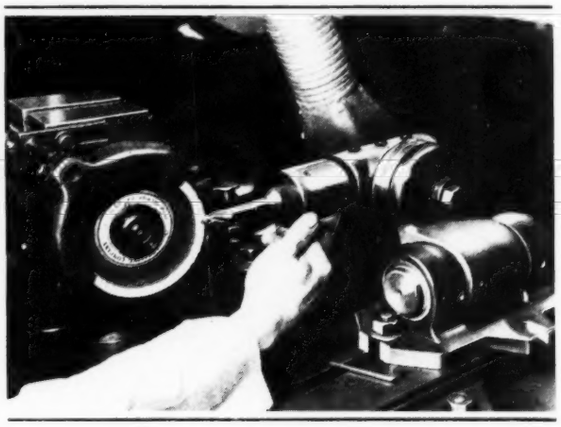
Reaming and Tapping Machine Brought out by the Hole Engineering Service

Speeds of 200 to 4000 revolutions per minute are obtained by changing pulleys on the V-belt drive which is enclosed by a removable sheet-steel guard. The motor is mounted on a swinging plate which provides for belt adjustment.

The fixtures can be mounted on round bar guides which insure accurate alignment with the spindle. The positions of the brackets which carry the guide bars can be reversed on the headstock so that the guides can be located in line with or below the center line of the spindle as required. The illustration shows the guide bars located below the center line. A table with a lever feed can be fitted to the guides. Special fixtures are located by a large keyway running the length of the table. An ample cutting lubricant chamber with baffle and clean-out cover is provided with an outlet connection for motor-pump mounting at the rear. 70

To obtain additional information on equipment described on this page, see lower part of page 460.

Fig. 1. G E Oilproof Push-button Stations



Cutter-Grinding Fixture Made by Putnam Tool Co.

General Electric Oilproof Push-Button Stations and Rotary Cam Switch

A line of compact, standard-duty, push-button stations specifically designed to resist the deteriorating action of oil and dirt encountered in machine tool applications has been brought out by the General Electric Co., Schenectady, N. Y. These small stations are provided with a graphite-treated packing ring between the button and the bushing or oil guard, which prevents oil or grease from the operator's gloves or hands from entering the button mechanism. These buttons are made in flush-mounted, surface-mounted, momentary-contact, and selector-switch units.

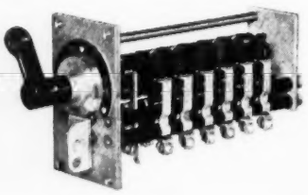


Fig. 2. General Electric Rotary Cam Switch

A rotary cam switch for multi-circuit arrangements has also been brought out by this company for use in conjunction with machine tool equipment. The switch consists of a series of cam bushings mounted on a shaft supported by two end plates. The assembly is held securely by tie-rods attached to the end plates. Steel-backed, silver-to-silver contacts are used to insure long life. The supports for these contacts are mounted securely on the tie-rods and are insulated by tubes of high dielectric strength. This switch can be obtained with a maximum of ten circuits and as many as twelve positions in 360 degrees of rotation. 71

Putnam Cutter-Grinding Fixture

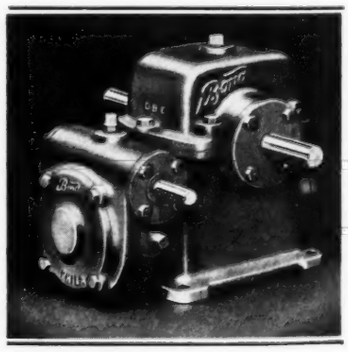
The Putnam Tool Co., 2981 Charlevoix St., Detroit, Mich., has brought out a swivel type grinding fixture for use in sharpening end-mills and other cutting tools. This fixture, designated the Putnam universal grinding fixture, operates on the same principle as grinding between centers, the horizontal motion required in the sharpening operation being controlled by the movement of the machine table. The holding unit is of ball-bearing construction and revolves at the slightest touch. The tool is locked securely in this unit and is always held in the correct position for grinding. Eight units are furnished with each fixture to cover the entire range of end-mill sizes from 1/16 inch to 2 inches in diameter.

While primarily designed for sharpening end-mills, this fixture can be used in regrinding a wide variety of cutting tools. End teeth can be ground correctly by turning the fixture at right angles to its usual position on the machine table. Graduations are provided on the top section of the fixture, of which the holding unit is a part, for use in grinding the tool at an angle. Any taper can be obtained.

The tool can be easily replaced without endangering the hands or affecting the machine and fixture settings, by withdrawing the swivel-arm completely away from the grinding wheel. 72

Bond Speed Reducers

A new series of speed reducers has been brought out by the



Bond Double-reduction Speed Reducer

To obtain additional information on equipment described on this page, see lower part of page 460.

Charles Bond Co., 617-623 Arch St., Philadelphia, Pa., that have much higher ratios, combined with greater capacities, than those formerly available in the double-reduction units made by this company. The new units, designated Bond B type double-reduction speed reducers, are capable of handling inputs up to 2 horsepower, and are made for reduction ratios as high as 4000 to 1 in both horizontal and vertical types. Worm-gears of bronze and worms of hardened steel are used in these units to insure long life and silent operation. 73

Sundstrand Oil Power Fluid Motor

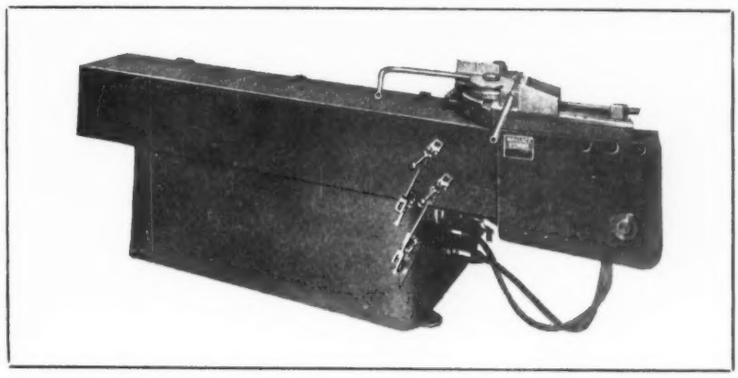
The Sundstrand Machine Tool Co., 2530 Eleventh St., Rockford, Ill., has recently announced a new oil power fluid motor of the multiple-piston type, designed

Sundstrand 4-MC Model Oil Power Fluid Motor

especially for machine tool feed applications. This motor has two speeds, a low one for feeding slides, carriages, tables, etc., and a high one for rapid traversing.

A feed range of from 3 to 120 revolutions per minute and a rapid traverse rate of 2000 revolutions per minute can be obtained with this motor by driving it with the standard pumps used to provide feeding movements by means of a piston and cylinder. The feed rate is varied by adjusting the variable-displacement feed pump, the rapid traverse speed being constant.

This motor has a high stalling torque rating. The unit shown in the illustration is designated the 4-MC model and has a rating of 100 inch-pounds per hundred pounds pressure for feeding. It is small and compact, being only 6 1/2 inches in diameter across the face of the flange and 9 1/2 inches over all. 74



Wallace 90-degree Pipe Bending Machine with Arm Shown at Finish of 90-degree Bend

Wallace Hydraulic Pipe Bending Machines

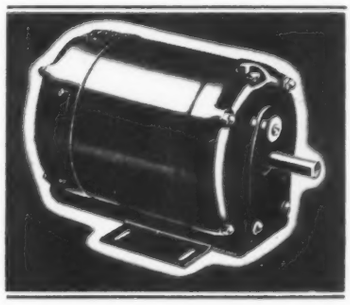
The new 500 series hydraulically operated pipe bending machines brought out by the Wallace Supplies Mfg. Co., 1310-12 Diversey Parkway, Chicago, Ill., are designed for general bending work and are available in forty-four production ranges. These machines are of all-steel electric arc-welded construction and cover a bending range of from 1/4-inch pipe to 8-inch extra heavy pipe. They are all hydraulically controlled, all valves being located within the oil-tight body of the machine. Operation is fully automatic, all movements being controlled by two hand-levers or pilot valves.

The production rates range from 300 or more bends per hour in the No. 502 machines having capacities for bending 2- to 3-inch tubing to 4 bends per hour on 8-inch extra heavy pipe. All hydraulic working parts are enclosed within the all-steel base. The machines are built in two styles, one being designed to make 90-degree angle bends, and the other 180-degree bends. The machines can be adjusted for any degree of rotation within their respective capacities. 75

Motor with Over-Drive Belt-Tightening Arrangement

A special streamline belt-tightening motor designed for over-drives such as are required for furnace blowers, where the belt must pull on the top side of the pulley so that the air will be driven into the bottom part of the furnace, has been brought out by the Ohio Electric Mfg. Co., 5929 Maurice Ave., Cleveland, Ohio. Belts used in such installations tend to lengthen after a few weeks service, and it is the function of the tightening feature of these motors to compensate for the increased belt length and thus prevent interruption in the service of the unit.

The motor is supported above and off the shaft center, so that



Over-drive Belt-tightening Motor Made by Ohio Electric Mfg. Co.

To obtain additional information on equipment described on this page, see lower part of page 460.

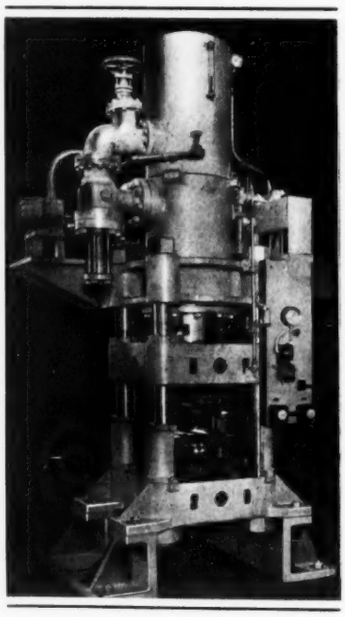
its own weight provides the initial belt-tightening effect, which is increased proportionately to suit the load conditions by the reaction of the motor to the stator. This reaction causes the motor to swing away from its load, thus tightening the belt the proper amount.

A belt-tightener without springs for under-drive belts such as are usually employed for driving pumps and compressors is also being placed on the market by this company. The motor is resiliently supported off and below the shaft center. Capacitors and thermal over-load cut-out switches can be incorporated in the end bell of the motors if required. 76

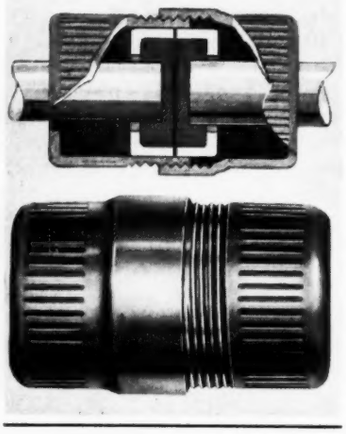
Lake Erie 300-Ton High-Speed Press

A 300-ton press designed to operate at speeds up to 20 strokes per minute at full capacity has been developed by the Lake Erie Engineering Corporation, Buffalo, N. Y. This press is suited for a wide range of production operations, being particularly adapted for stamping and coining. Sensitive controls are employed to give complete control of power, speed, and pressure.

The selector control can be set to permit jogging, single-cycle operation, or continuous operation as required. These operations are controlled by two push-buttons located on the control panel. The pressure is adjustable up to the full 300-ton capacity, and the dwell at the top of the stroke is also adjustable. The maximum adjustable stroke is 12 inches. The distance between columns, right to left, is 24 inches, and front to back, 36 inches. The opening is 27 1/2 inches. 77



High-speed Press Built by Lake Erie Engineering Corporation

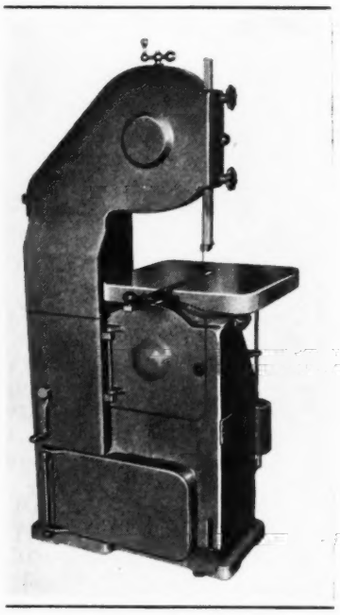


Cross-section and Assembly Views of "Torflex" Coupling

Gordon Flexible Couplings

A flexible coupling for shafts, known as "Torflex," designed to eliminate vibration and whipping, has been brought out by the Gordon Engineering Co., 3576 Gratiot Ave., Detroit, Mich. Power is transmitted to the driven shaft through rubber bushings bound to the shafts as shown in the upper view of the accompanying illustration.

It is claimed that these couplings will transmit power efficiently even when the shafts are out of alignment. They are made in four standard types for shafts from 7/16 inch to 1 1/2 inches in diameter, with torque capacities from 40 to 650 inch-pounds. ... 78



Band Saw with Capacity for Cutting Steel 8 Inches Thick

Grob Metal-Cutting Band Saw

An improved metal-cutting band saw, designated Type NS-14, has recently been added to the line of diemaking machines made by Grob Bros., Grafton, Wis. This machine will cut various shapes from thin sheet metal or steel up to 8 inches in thickness. A silent V-belt drive from a 1/2-horsepower motor in the base gives the band saw speeds of 60, 90, 135, 225, and 375 feet per minute. These five speeds are suitable for cutting a variety of materials ranging from wood to tough alloy steel.

The table is 20 by 20 inches and can be tilted in two planes. It can also be rotated without releasing the feeding pressure. Provision is made to prevent feeding the work too fast, a hydraulic cylinder arrangement serving to check the feed when the saw blade cuts into an opening, thus preventing saw breakage.

The saw guides are made of a material that will not injure the saw or "build up" with steel, but will maintain a close guiding fit on the saw. The lower guide can be positioned flush with the table or raised several

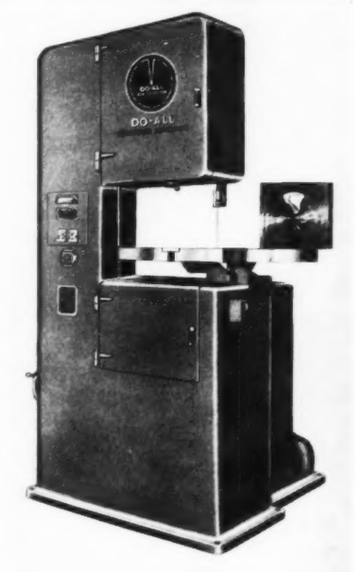
To obtain additional information on equipment described on this page, see lower part of page 460.

inches above the table for certain work. This arrangement provides support for the saw immediately above and below the work. A slot in the table facilitates changing joined saws. An electric brazer, a saw clamp, and a file are furnished to facilitate joining saw blades for internal sawing operations. 79

Doall Contour Machine

A new "Doall" contour machine designated V16 has just been placed on the market by Continental Machine Specialties, Inc., 1301 Washington Ave., S., Minneapolis, Minn. This machine has a throat capacity of 16 inches and two ranges of infinitely variable speed. It is similar in style to the larger "Metalmaster" machine made by this company. Like the latter machine, it has a built-in automatic butt-welder and a four-way tilting table.

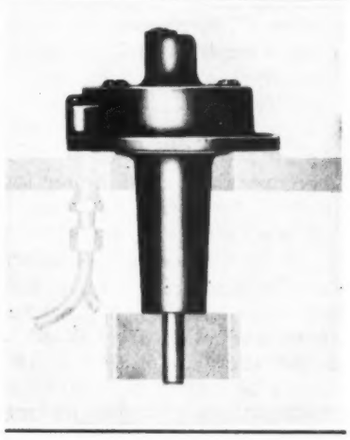
A new two-piece file-backing member is provided for use in filing. This arrangement facilitates internal filing operations. The lower range of speeds is from 75 to 450 feet per minute, while the upper range is from 450 to 2800 feet per minute. This machine is adapted for handling production sheet-metal fabricating, as well as tool-room work. A "job selector" indicates the correct speed to use for each sawing, filing, or polishing job. 80



Doall Sawing, Filing, and Polishing Machine

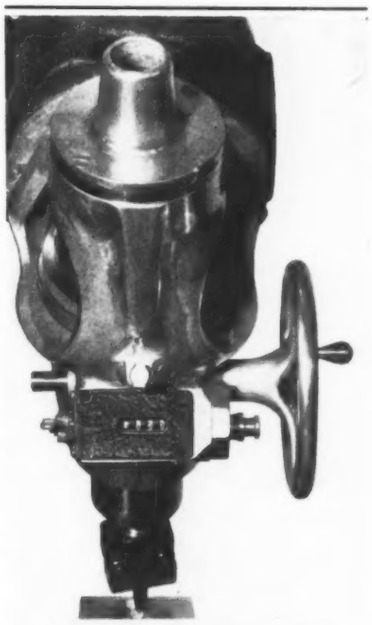
Pioneer Rotary Lubricating Pump

A new Rollway machine pump, designated the ASE model, has recently been brought out by the Pioneer Engineering & Mfg. Co., 31 Melbourne Ave., Detroit, Mich., for the lubrication of bearings, gears, multiple-spindle drill heads, and other similar units. This small, positive-displacement, rotary pump can be mounted on practically any flat surface of the machine. All moving parts of the pump are made of hardened steel and are accurately ground.



Pioneer Lubricating Pump

When mounted against the outer surface of the machine, this pump can be connected or disconnected without disturbing either the pipe lines or the drive gears. Inlet and outlet ports through the machine casting are permanently connected with the discharge and supply pipes inside. The high vacuum obtained with this pump serves to deliver liquid immediately after rotation is started. Stopping or reversing of the machine has no effect on the pump operation. 81



Dalrae "Thou-meter" which Registers Movements of 0.0001 Inch

Dalrae Motor-Driven Milling Attachment for Milling Machines

The Dalrae Tools Co., Syracuse Bldg., Syracuse, N. Y., has recently brought out the "Midgetmill" milling attachment as a companion to the "Speedmill" described in the June, 1937, number of MACHINERY. The "Midgetmill" is similar in size to the previously described boring and drilling attachment, but is equipped with a quill feed for drilling, boring, and milling operations. This motor-driven milling attachment is mounted on the over-arm of any type milling machine. It provides the range of speeds needed for the operation of end-mills from 1/16 up to 3/4 inch in diameter, giving six speeds from 275 to 3600 revolutions per minote.

The feed is obtained by means of a large handwheel which rotates a hardened and ground worm in mesh with a bronze nut housed in a stationary position between ball thrust bearings. An entirely new method of positioning the cutting tool is employed, a device known as the "Thou-meter" being used, which

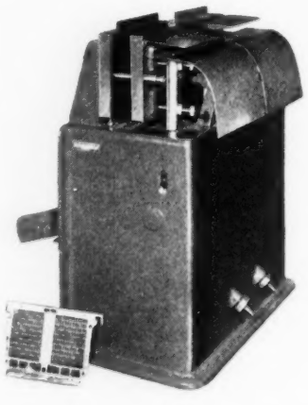
To obtain additional information on equipment described on this page, see lower part of page 460.

registers in thousandths and provides direct reading for the depth of cut. The "Thou-meter" is shown in the accompanying illustration. The registering feature is obtained by a system of gearing driven from the worm-shaft which operates the "Thou-meter." A movement of 1/4 inch on the meter represents a movement of 0.0001 inch on the quill. It is claimed that extremely accurate readings can be obtained. 82

Automatic Machine for Casting Battery Plates

An automatic casting machine, with which one man can turn out 12,000 single grids for storage batteries in eight hours, has been developed by the Battery Mould Division of the Howe Machinery Co., Inc., 30 Gregory Ave., Passaic, N. J. When this machine is in operation, the lead is poured into the molds by hand from the lead pot directly in front of the machine. Two molds are mounted side by side. While one is being poured the opposite one opens and knocks out the finished casting.

The finished castings drop down a chute and into a receptacle on the floor. The machine is driven by a 1/2-horsepower motor through a heavy-duty worm-gear, ball-bearing type speed reducer. Guards are attached to the molds to keep the lead drippings from entering the mechanism. This machine is primarily a battery grid casting machine, but it can be used for casting practically any small product made of lead. 83



Howe Battery Plate Casting Machine

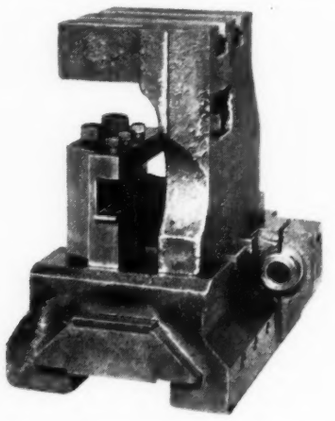
Dalzen-Slitters Accessories for Automatic Screw Machines

An improved line of accessories designed for use on Gridley automatic screw machines has been developed by the Dalzen Tool & Mfg. Co., 511 Leib St., Detroit, Mich. This line includes the Slitters self-contained unit forming slide, shown in the accompanying illustration, and the double-deck block shown mounted on the slide. The slide provides means for the rapid handling of large jobs with fewer operations and longer tool life, and for handling work as smoothly and accurately as though it were one solid piece. The adjusting gibs and moving parts are made from hardened and ground alloy steel fitted to scraped surfaces of nickel iron, and can be bolted in place without alterations to either the machine or slide.

The double-deck block mounted on the slide is made from steel castings to fit the various sizes of Gridley automatic machines. These blocks are adapted for handling two-position work at the same time. They are finished ready for application to a machine. As in the case of the other accessories here described, these standard blocks are carried in stock, while special blocks are made to order.

The Slitters cut-off slide is another self-contained unit for Gridley automatic screw machines which is machined ready to bolt in place without any alteration. It is made from hardened and ground alloy steel and has an adjusting gib for wear.

A roller-bearing threading spindle (not illustrated) is another development for use on work necessitating a long range



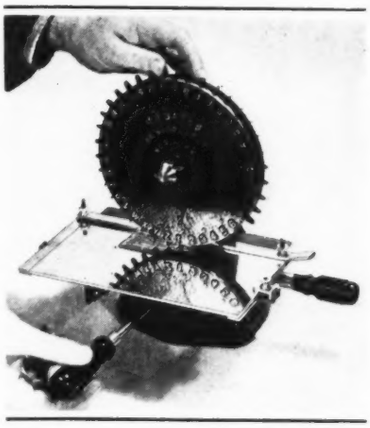
Dalzen-Slitters Slide and Double-deck Block for Gridley Automatics

of telescopic action. This threading spindle is very sensitive and enables smooth, accurate threading to be done. It will open or extend to a length of 13 1/2 inches, and will close to a length of 8 1/4 inches, giving 5 1/4 inches, of telescopic movement on the 9/16 to 7/8 Gridley machines. It is made from hardened and ground alloy steel with roller construction, which combines sensitivity with rigidity. The spindle will fit any style diehead without alterations, and can be used for either right- or left-hand threading. 84

Bates Nameplate Stamping Machine

Several improvements have been incorporated in the nameplate stamping machine made by H. O. Bates, 68 Barclay St., New York City. This machine is designed to stamp evenly spaced, properly aligned letters and figures rapidly into metal, fiber, plastics, and other materials. A nameplate or other piece to be marked is placed on the adjustable table of the machine and held by a clamp. The dial is rotated to the desired letter or figure and the impression made by operating the machine handle, which also advances the table to the stamping position for the next impression.

To obtain additional information on equipment described on this page, see lower part of page 460.



Nameplate Stamping Machine Made by H. O. Bates

Complete names and all numbers can be stamped with this machine, as it carries a complete alphabet and set of figures. Each separate die is hand-made and ground for accurate alignment. The improved machine has a worm instead of a ratchet for moving the table. This gives a positive and uniform movement. Other improvements are in the materials used, which increase the strength of the machine. The table is now plated to prevent rusting. The handle at the right enables the operator to position the table accurately. Improvements have also been made in the alignment and spacing of the characters.

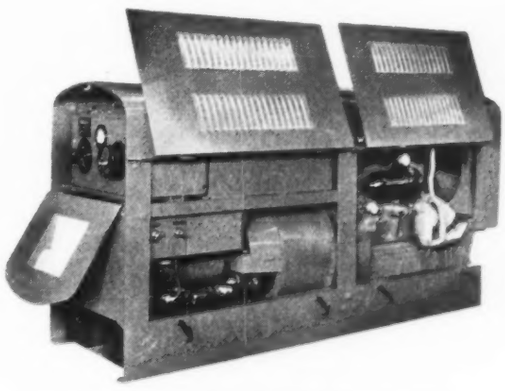
The machine is about 10 inches high, weighs about 30 pounds, and will stamp materials as hard as stainless steel. Nameplates up to 8 inches long and 1/4 inch thick can be stamped in this machine. The depth of throat is 3 inches. Machines can also be furnished with a throat depth of 5 inches. 85

Diesel-Engine Driven Arc Welder

A Diesel engine that compares favorably with gasoline engines in simplicity, weight, and cost, as well as in operating speed, has been adapted for driving arc-welding generators by engineers of the Lincoln Electric Co., Cleveland, Ohio, in collaboration with Diesel engine manufacturers.

The new Diesel-driven welder is the result of extensive research and testing, with the aim of developing a power plant of correct design and construction to meet the requirements of welding service. At full-load operation, the engine uses only 1 1/2 gallons of fuel oil per hour, as compared with 2 3/4 gallons of gasoline per hour required for the conventional gasoline-engine driven welder. The main welding generator is used to start the engine, standard 6-volt automobile batteries, charged by the exciter, being used to furnish the current.

The arc-welding generator used on the machine illustrated is the 300-ampere "Shield-Arc SAE" unit equipped with dual-continuous control, which provides the right size and type of arc for all electric welding applications. The principal features of this generator include continuous voltage control; continuous current control; all-purpose meter; and other equipment developed to insure economical and efficient operation. 86



Diesel-engine Driven 300-ampere Arc-welding Machine Brought out by Lincoln Electric Co.

G E Dew-point Potentiometer for Testing Furnace Atmospheres

General Electric Dew-Point Potentiometer

For determining the moisture content of the atmosphere in metal heat-treating furnaces, the General Electric Co., Schenectady, N. Y., has developed a portable dew-point potentiometer. This instrument consists of a polished metallic mirror located in a small chamber which can be seen through a sight glass, and means for cooling the mirror and reading its temperature. The gas to be tested is passed continuously through the chamber while the temperature of the mirror is lowered by a jet of carbon dioxide or other gas from a storage tank which is directed against its back. When the dew-point temperature of the gas is reached, a spot of dew appears on the mirror. The formation of dew on the mirror is easily observed.

A light-gage thermocouple and a balancing unit with a direct-reading meter permit accurate reading of the mirror temperature at the instant the dew appears. This is the dew-point temperature of the gas being tested, and with this data, the weight of water vapor per cubic foot of gas or other convenient unit can be determined.

To obtain additional information on equipment described on this page, see lower part of page 460.

The range of dew-point temperatures of the instrument is from 130 to minus 40 degrees F. 87

Libert High-Speed Shear for Trimming Flash from Stampings

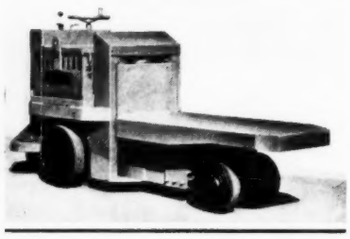
The Model 1036 high-speed shear made by the Libert Machine Co., Green Bay, Wis., has recently been built with a special lower cutting head that permits extreme flexibility in cutting formed pieces of sheet metal. It will cut on a formed radius as small as 5/8 inch up to 90 degrees, and is especially suited for trimming the flash from stampings after the first drawing operation. When thus employed, it eliminates the need for trimming dies. It can also be used to advantage on short runs, or when the formed piece is of rather large or bulky shape, such as automobile fenders of the design shown.

This machine can be used for cutting irregular shapes from sheet metal, the same as the standard type shear. No starting holes are required for inside cutting. The machine shears the metal accurately, no further finishing being required. 88

Libert Metal-trimming Shear

Mercury Low-Lift Elevating Truck

A truck of 6000 pounds capacity, with an elevating platform 27 inches wide by 66 inches long which can be lowered to a height of 18 inches and raised to a height of 24 inches above the ground, has been brought out by the Mercury Mfg. Co., 4118 S. Halsted St., Chicago, Ill. The illustration shows the platform in the maximum raised position. The wheels of this truck are equipped with rubber tires, and the drive is of the double-reduction spiral-bevel and spur gear type.

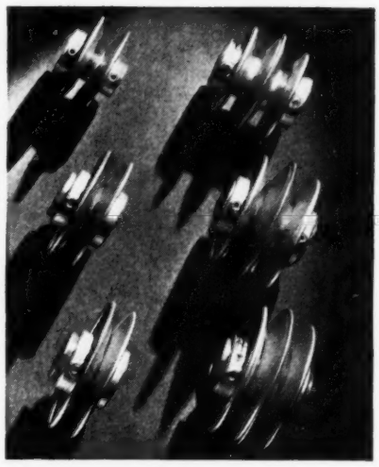


Mercury Elevating Platform Truck

A snap-action controller provides three travel speeds forward and reverse. Platform elevation is accomplished hydraulically. The truck will accommodate either a battery box compartment or a gas-electrical unit. 89

Texsteel Sheaves with Adjustable Pitch Diameters

A new series of two-groove adjustable pitch-diameter Texsteel sheaves which make possible a speed variation up to 33 per cent on any driven unit has been brought out by the Allis-Chalmers Mfg. Co., Milwaukee, Wis. These sheaves are designed to provide a sturdy, inexpensive, and easily adjusted variable-speed drive for applications where the load does not exceed 3 horsepower. They are available in three sizes having adjustment ranges of 2 to 3 inches; 2.5 to 3.5 inches; and 3.5 to 4 inches.



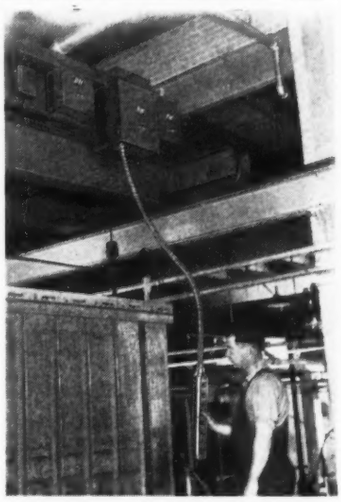
Sheaves with Adjustable Pitch Diameter Made by the Allis-Chalmers Mfg. Co.

The pitch diameters of these sheaves are easily changed by stopping the motor, relieving the belt tension, releasing the headless locking screw, and turning the adjustable plate in or out to give the desired pitch diameter. The sheaves are furnished complete with a wrench for the Allen head locking screw and a circular calculator showing directly the speeds of the driven unit.

The stationary part of the sheave hub is cast integral with the steel plates, so that hard usage cannot loosen the plates. The movable portion of the hub is similarly constructed with sufficient metal to form an external brace on the outside plate, thus assuring a smooth, true running sheave.

An intermediate diameter Texsteel sheave has been added to the single-groove adjustable pitch-diameter series. This sheave also has a speed variation of 33 per cent for ratings up to 1 1/2 horsepower. Both the single- and double-groove adjustable-pitch series have wide applications in small commercial units of various kinds, including heating, ventilating, and air conditioning equipment for use in residences. 90

To obtain additional information on equipment described on this page, see lower part of page 460.



Harnischfeger Push-button Controller for Hoist

Push-Button Controller for Floor-Operated Hoist

A push-button variable-speed controller for floor-operated hoists and cranes which has five control steps, has been developed by the Harnischfeger Corporation, 4400 W. National Ave., Milwaukee, Wis. With this new controller, there is only one push-button unit suspended from the hoist, instead of two to six ropes, as required for the face-plate or drum type variable-speed controllers. Thus there are no ropes to become tangled or twisted and cause the hoist to operate in the wrong direction. The push-button case, with any required number of control buttons, can be suspended by a multi-conductor cable, as shown in the illustration.

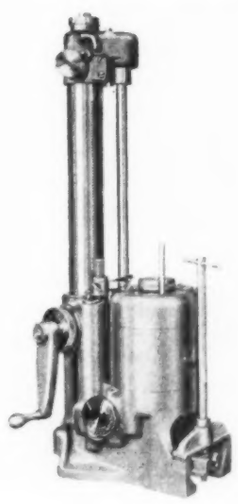
Speed variation is effected by depressing the variable-speed button. The motor starts slowly, and as the operator depresses the button further, the speed of the motor increases. Five distinct steps or speeds are obtainable. Any speed can be maintained by the operator when either accelerating or decelerating the motor speed. This type of control is adaptable for either direct-current or alternating-current slip-ring motor operation. It can be used on direct-current installations with either low breaking or dynamic lowering control. 91

Van Norman Heavy-Duty Portable Boring-Bar

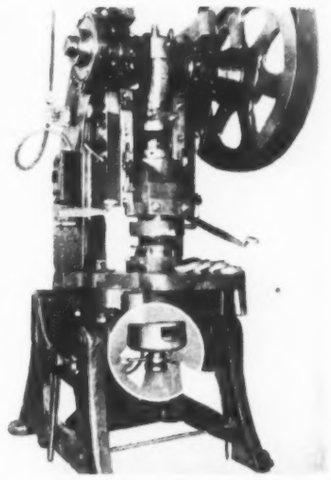
A heavy-duty boring-bar, designated Per-Fect-O No. 777, has been brought out by the Van Norman Machine Tool Co., Springfield, Mass. This boring equipment is designed for rapid, powerful, and accurate boring It will take heavy cuts at high speed, yet is light enough for one man to handle. It will bore holes from 2.600 to 5.343 inches in diameter. A 1/2-horsepower motor provides ample power throughout the working range.

The machine is a complete unit and has two feeds and two speeds. It will take a 0.050-inch cut at any diameter within its capacity. Heavy-duty tool bits are standard equipment. The heavy-duty gears are totally enclosed, and are provided with sufficient lubricant for the life of the tool.

Non-revolving, expanding cat's-paws which guide the fly cutter all the way to the bottom of the bore insure obtaining an accurate finish in one cut without requiring a honing operation. 92



Van Norman Portable Boring-bar



Drawing Press Equipped with Dayton Rogers Die Cushion

Dayton Rogers Improved Die Cushion

An improved Model A pneumatic die cushion, which is completely self-contained and can be easily mounted on the bolster plate of practically any punch press, as shown in the accompanying illustration, has been brought out by the Dayton Rogers Mfg. Co., Minneapolis, Minn. These cushions are now produced in eight sizes having piston diameters varying from 4 to 16 inches and drawing capacities from 2 1/2 to 5 1/2 inches.

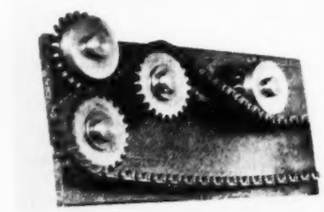
No surge tank is required for standard drawing operations, as the air cushion is connected directly to the shop air-line, with all pressure regulating equipment conveniently mounted in the operating position on one side of the press.

These cushions can be used for controlling pressure pads and the action of strippers on compound blanking and piercing dies, as well as for all drawing operations. They will operate satisfactorily at an air pressure of 15 to 160 pounds, producing draw-ring holding pressures from 1/8 ton to 9 tons. These cushions are now supplied with a new type of synthetic rubber cup packing that is not affected by oil or grease. 93

To obtain additional information on equipment described on this page, see lower part of page 460.

Ramsey Duplex Sprocket Chain

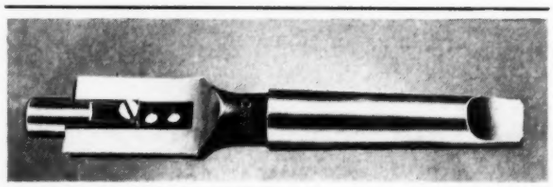
A "Duplex" sprocket chain resembling two narrow-side guide chains so constructed that the links of each chain point in opposite directions for the purpose of driving sprockets from each side has been brought out by the Ramsey Chain Co., Inc., Albany, N. Y.



Ramsey Duplex Chain Designed to Drive from Both Sides

Narrow-face sprockets are used which engage but one-half of the chain, their hubs supporting the other half.

This chain is designed for driving groups of rolls or other installations where the sprockets must be placed close together. Any number of sprockets, spaced as desired, can be driven from either side of this chain. 94



C & W Two-lipped High-speed Counterbore

C&W High-Speed Counterbore

A counterbore with a two-lipped cutter and interchangeable pilot has been added to the line of the C & W Tool Co., 19 Chestnut St., Cambridge, Mass. This tool is designed for fast, clean cutting, especially for deep counterboring.

The pilot supports the cutting edge in such a manner as to insure greater strength and accuracy. It can be easily removed and the cutter accurately sharpened by hand. The method of attaching the pilot insures the cutter against breakage should the pilot become fouled or caught in the work. The tool can be run at high speeds without heating. 96

Delong-Cramer Electrode-Holder

An electrode-holder with an air-cooled handle and a fiber heat-shield that protects the operator and prevents short circuits if the tool is laid down has been developed by the Delong-Cramer Co., Southgate, Calif. This holder is made in three sizes to take rods from 1/16 to 3/8 inch in diameter. The fiber handle is uniform for all sizes and is fitted with replaceable heat-treated spring steel jaws which permit quick insertion of the rods in any position. The largest size weighs only 22 ounces. 95

Electrode-holder Developed by the Delong-Cramer Co.

Tool Engineers to Meet in Detroit

The technical sessions of the annual meeting of the American Society of Tool Engineers in Detroit, March 9-12, will be held in the evenings in order to leave the daytime free for inspecting the Tool Exhibition and for plant visits. At each evening session the paper and discussion will be confined to one major topic of interest to production men. At the Wednesday evening session, March 9, the subject will be "Standards for Surface Quality." Thursday night the topic will be "Selecting and Buying Equipment." J. R. Weaver, director of equipment of the Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., will act as chairman at both of these sessions. The speaker at the Society's annual dinner, which will be held Friday night, March 11, will be Ralph E. Flanders, president of the Jones & Lamson Machine Co., Springfield, Vt.

Frank A. Shuler, President of the American Society of Tool Engineers

* * *

High Cost of Government

It is estimated that the Federal Government and the State, County, and Municipal Governments of the United States spend $30,000 of the taxpayers' money for every minute, day and night, throughout the year. No wonder taxes run high! When will we begin to realize that we are paying a very high price for being so extravagantly governed?

To obtain additional information on equipment described on this page, see lower part of page 460.

NEWS OF THE INDUSTRY

California

R. A. SANGUINETTI has been appointed western division manager of the Timken Roller Bearing Co., Canton, Ohio, and will have charge of the sales of industrial, automotive, and service bearings, as well as rock bits and fuel injection equipment. His office is at 1800 Van Ness Ave., San Francisco, Calif.

Illinois

BARNES DRILL CO., Rockford, Ill., elected the following officers at the company's annual meeting: J. E. ANDRESS, chairman of the board; A. M. JOHNSON, president; W. M. FAIRBAIRN, first vice-president and works manager; REED M. ANDRESS, second vice-president and foreign sales manager; and A. G. BLOCK, secretary and treasurer. J. E. Andress, who takes over the chairmanship, has been president of the company for a number of years. A. M. Johnson, the new president, has been with the company since its organization by B. F. Barnes and J. E. Andress in 1907. He has been chief engineer for several years.

CHICAGO-LATROBE TWIST DRILL WORKS, 411 W. Ontario St., Chicago, Ill., manufacturers of Double Circle twist drills, reamers, and special tools, announce the election of HARVEY B. BOWER as vice-president in charge of their newly opened branch office and stock-room at 910 N. Fourth St., Milwaukee, Wis. The company also announces the opening of a branch office and stock-room at 20 Penn Ave., Pittsburgh, Pa., with CLARENCE W. KRUEGER in charge as vice-president.

MECHANICS UNIVERSAL JOINT CO., Rockford, Ill., a division of the BORG-WARNER CORPORATION, has just completed the construction of a $500,000 factory building, the largest industrial development undertaken in Rockford for many years. The new factory, a one-story structure of steel, concrete, and brick, covers an area of 5½ acres, the actual floor space of the new plant being 234,000 square feet.

FAIRBANKS, MORSE & CO., recently moved its general offices to larger quarters at 600 S. Michigan Ave., Chicago, Ill. The first five floors of the building are occupied by the executive, sales, and departmental offices. There is a display room on the first floor, where some of the company's products are shown.

TOOL EQUIPMENT SALES CO., Chicago, Ill., announces that the company is moving to new and larger quarters from 4625 Fulton St. to 24 S. Pulaski Road.

Michigan

CARL SWANSON and T. B. BUELL, of the Sundstrand Machine Tool Co., Rockford, Ill., recently spoke before the Detroit chapter of the American Society of Tool Engineers. The speakers explained the functioning of the Sundstrand new hydraulic power mechanism and also showed a motion picture of the Sundstrand new "Process Miller," an entirely automatic machine that mills completely all the surfaces of a cylinder block.

PHIL HUBER, president and general manager of the Ex-Cell-O Corporation, Detroit, Mich., at a recent meeting of the board of directors of the National Machine Tool Builders' Association, was made a director to fill the vacancy created by the resignation of NEWTON A. WOODWORTH, formerly first vice-president of the Association. W. E. WHIPP was elected first vice-president to succeed Mr. Woodworth.

New England

FLAVEL W. WOODWORTH, the oldest employe of the Pratt & Whitney Division of Niles-Bement-Pond Co., Hartford, Conn., celebrated his eighty-seventh birthday on January 22. Mr. Woodworth became connected with Pratt & Whitney at the age of seventeen, and this year marks the seventieth anniversary of his employment with the company. In honor of the occasion, Clayton R. Burt, president of the company, congratulated Mr. Woodworth in the presence of twenty-four of the company's oldest employes. The average length of employment of these twenty-four men is forty-two years.

MANNING, MAXWELL & MOORE, INC., Bridgeport, Conn., manufacturers of valves, gages, and control instruments for industrial plants, announce that, in accordance with the company's belief that the present business recession is merely temporary, the company has increased its general field sales organization by 25 per cent. In other words, the company has added nine new salesmen to its staff, continuing a policy that it has followed since 1930.

L. J. ST. CLAIR, of the Carboloy Co., INC., Detroit, Mich., recently spoke before the Bridgeport, Conn., chapter of the American Society of Tool Engineers on the designing, brazing, and grinding of carbide tools.

L. C. KING has been appointed representative of the Fellows Gear Shaper Co., Springfield, Vt., in the New England territory, succeeding J. B. STRONG, who died recently. Mr. King was associated with Mr. Strong for many years.

New Jersey

WESTINGHOUSE ELECTRIC & MFG. CO., has reorganized its manufacturing facilities at Bloomfield, N. J., to form a Special Products Division, under the management of H. J. HOFFMAN. The new division embraces the design, manufacture, and sale of electronic tubes. The Bloomfield plant will continue to manufacture a complete line of radio transmitting tubes, X-ray tubes, etc.

ARTHUR A. CRAFTS CO., INC., 532 Commonwealth Ave., Boston, Mass., tool manufacturers and designers specializing in hard metal alloys and tools, recently opened a branch sales office and shop at 17 William St., Newark, N. J.

New York

PROFESSOR WILLIAM N. BARNARD has been named director of the Sibley School of Mechanical Engineering in the College of Engineering by the board of trustees of Cornell University, Ithaca, N. Y. Professor Barnard, a graduate of Cornell in 1897, has been, with the exception of two brief periods, a member of the faculty ever since. Since 1907 he has been professor of heat-power engineering. He has been head of the department for eighteen years, and during the past year and a half has been acting director of the Sibley School of Mechanical Engineering. He has written several books and articles on heat-power engineering.

DR. ERNST E. WACHSMUTH has joined the staff of the American office of the Leipzig Trade Fair, Inc., 10 E. 40th St., New York City, as consulting engineer. The growing interest in America in the Leipzig Engineering and Building Fairs, and in recent engineering developments in Germany, made it advisable to add an engineering department to the American office. Dr. Wachsmuth is thoroughly familiar with engineering problems in both America and Germany and is in a position to secure and supply, without charge, information relating to German machinery, equipment, and manufacturing processes.

No. 20

10 x 18

AN OUTSTANDING NEW G

These Advanced Design Plain Grinding Machines offer a *new* opportunity for more profitable production grinding . . . *Investigate now*

Brown & Sharpe Mfg. Co., Providence, R. I., U.S.A.

BROWN &

Electrically Controlled

. . . . using **Proved Design** principles that give **Increased Productive Capacity** and **More Closely Controlled Accuracy**

NEW GRINDING DEVELOPMENT

B·S

No 22

10 x 36

BROWN & SHARPE

GEORGE SCHERR CO., 128 Lafayette St., New York City, now has the exclusive sale of Leitz optical measuring precision instruments, including various sizes and styles of toolmakers' microscopes, large and small projection apparatus, and microscopes for surface inspection, as well as for metallurgical purposes. A complete line of these tools will be on exhibit at the show-rooms of the George Scherr Co.

JAMES BOYD, formerly assistant eastern district manager of the Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., has been appointed eastern district manager, succeeding H. F. BOE, who has become commercial manager of the company. Mr. Boyd's headquarters will be at the Westinghouse Building, 150 Broadway, New York City.

HAMMOND MACHINERY BUILDERS, Kalamazoo, Mich., have found it necessary to move their eastern branch into larger quarters in order to take care of the increasing demand for Hammond products in the East. The new location is at 71 W. 23rd St., New York. W. J. HOLTMEIER is eastern manager.

A. G. ZIMA, west coast field representative of the International Nickel Co., Inc., 67 Wall St., New York City, recently addressed the Seattle and Oregon chapters of the American Society for Metals on the subject of the role of nickel in the development of modern cast irons.

OAKITE PRODUCTS, INC., 22 Thames St., New York City, recently held a conference of the Oakite division managers at the New York headquarters, at which three improvements in production and maintenance cleaning practices were discussed. One was the elimination of brushing and mechanical wiping in the removal of insoluble smuts, buffing compounds, and pigments from metals preparatory to finishing operations; the second dealt with safer and easier methods for removing hard water scale and rust from the water jackets of Diesel engines and other water-cooled equipment; the third covered the development of a new series of cleaning materials that resist chromic acid contamination.

CARL ZEISS, INC., 485 Fifth Ave., New York City, has appointed the following district representatives to handle the sales and servicing of its line of precision gaging tools: C. H. GOSIGER MACHINERY CO., Bacon and McDonough Sts., Dayton, Ohio; and W. A. KERR, 54 Chilton St., Belmont, Mass.

ERIK OBERG, editor of MACHINERY, sailed for Europe, February 26, on the *Europa*, to visit the machine tool and engineering exhibitions at Leipzig, Germany. While in Europe, Mr. Oberg will also visit a number of machine-building plants in Germany, Czechoslovakia, and Switzerland, to study recent developments in European shop practice.

W. A. MEITER has been appointed manager of the Buffalo, N. Y., sales office of the Worthington Pump & Machinery Corporation, Harrison, N. J., succeeding C. C. SCOTT, who will devote his entire time to special work in the Buffalo district.

Ohio

BUNTING BRASS & BRONZE CO., Toledo, Ohio, announces a number of changes in its sales staff personnel and location of branch establishments: WILLIAM C. BRACKEN has been placed in charge of the southeastern area, with headquarters in the company's sales offices and warehouse at 296 Ivy St., N.E., Atlanta, Ga. In Los Angeles, Calif., the company is consolidating its automotive and industrial products warehouses in one sales and service plant at 240 W. 18th St. I. ELDRED, formerly in charge of the Kansas City office, will have supervision over the Los Angeles branch. ALLAN HASTY, of the Toledo office, will replace Mr. Eldred in Kansas City.

A. L. BERGSTROM has been appointed executive engineer of the Timken Roller Bearing Co., Canton, Ohio, following the resignation of ERNEST WOOLER, chief engineer. Other promotions announced are as follows: R. M. RIBLET has been made chief engineer of the automotive division; J. B. BAKER, assistant chief engineer of the automotive division and chief engineer of the rock bit division; S. M. WECKSTEIN, chief engineer of the industrial division; H. C. EDWARDS, chief engineer of the fuel injection equipment division; W. C. MAKLEY, chief works engineer; and E. J. REAGAN, general service manager.

DI-MOLD CORPORATION, 109 Webb St., Dayton, Ohio, has bought the capital stock and assets of the MOLDED ALLOYS CO., INC., manufacturer of aluminum and zinc alloy castings, and will continue to make these products in addition to its regular line of Di-Mold aluminum match plates and wood and metal patterns. The officers of the corporation are as follows: FRED KOHNLE, president; R. E. ENGLE, treasurer and general manager; and ROBERT N. LLOYD, secretary. A. H. WITTE is manager of the die-casting department.

P. T. ANCARROW, formerly head of the Atlanta service branch of the Timken Roller Bearing Co., Canton, Ohio, has been appointed Atlanta division manager, in charge of all phases of activity of the company in the southeastern territory. His headquarters will continue to be at 280 Spring St., N.W., Atlanta, Ga. B. E. KEIFER has been appointed Cincinnati division manager of the company, in charge of sales and service in the Cincinnati territory for service and industrial bearings, rock bits, and steel.

Pennsylvania and Maryland

C. W. HEPPENSTALL, president and treasurer of the Heppenstall Co., Pittsburgh, Pa., celebrated his forty-fifth anniversary with the company February 12. Mr. Heppenstall, who is sixty-six years old, has been president of the company since 1920, and represents the fourth generation of a family engaged in the steel industry in England and America. The first Heppenstall was employed in a steel mill at Sheffield, England, in 1792. His son and grandson followed him in the business. The grandson, Sam Heppenstall, came to America and in 1889, he helped to organize the Trethewey Mfg. Co., now the Heppenstall Co. The present head of the company, C. W. Heppenstall, is one of the two sons of Sam Heppenstall.

BLAW-KNOX CO., has acquired the ELECTROCHEMICAL PROCESSES CO., Youngstown, Ohio, which will be operated as the ELECTROCHEMICAL PROCESSES DIVISION OF THE BLAW-KNOX CO. J. S. NACHTMAN, president of the Electrochemical Processes Co., will be in charge of the new Division, with offices at Groveton, Pa., Post Office Box 1586, Pittsburgh, Pa. The new Division will produce equipment for continuously plating tin, nickel, brass, bronze, terne plate, copper, etc., on steel and for the continuous

Oakite Division Managers and Headquarters Office Departmental Heads at a Recent Conference in New York